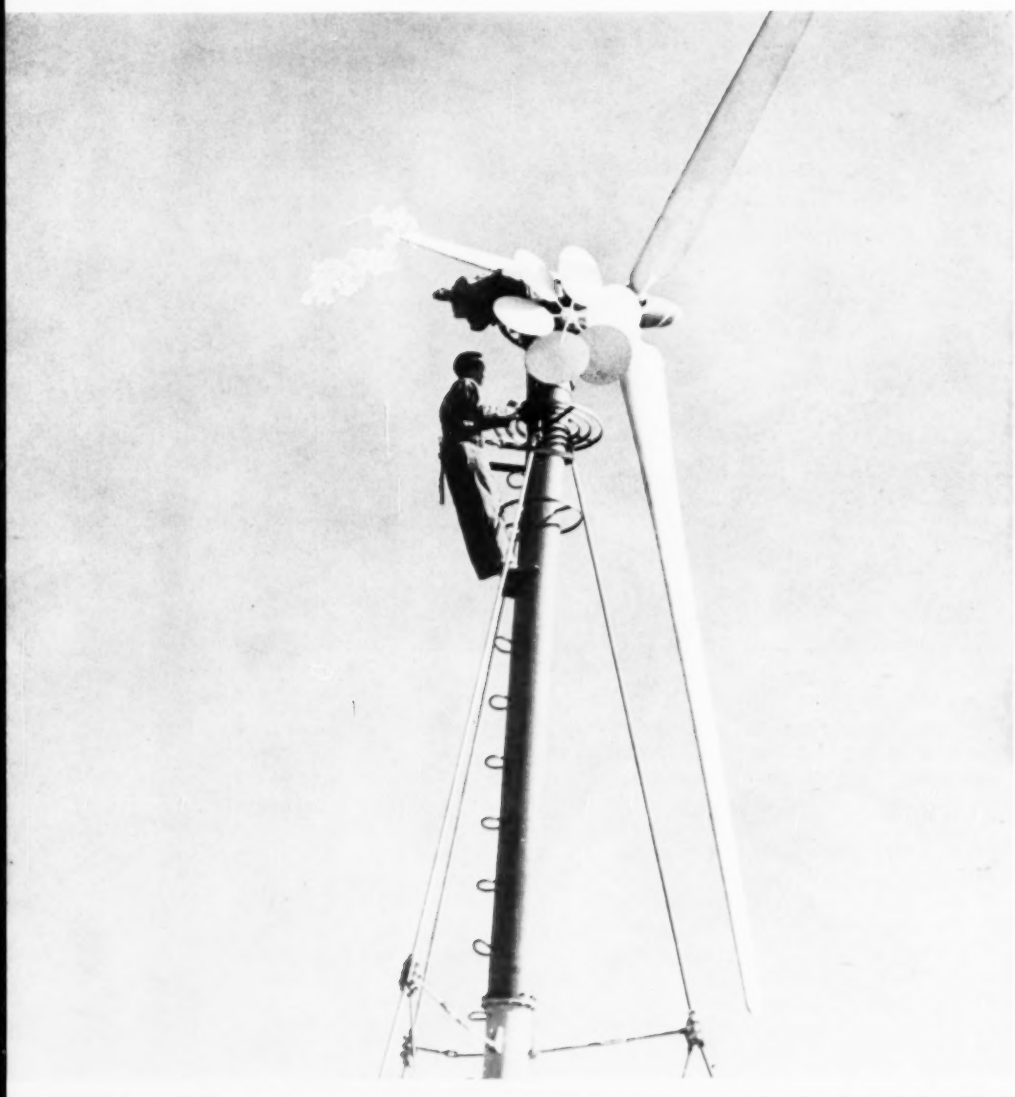
# Compressed Air Magazine



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**MARCH 1959**

IN THIS ISSUE

NEW FACE FOR GOTHAM LANDMARK
THE STORY OF AIR GUNS
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AERATED ANTIFREEZE
ABOUT WINDMILLS
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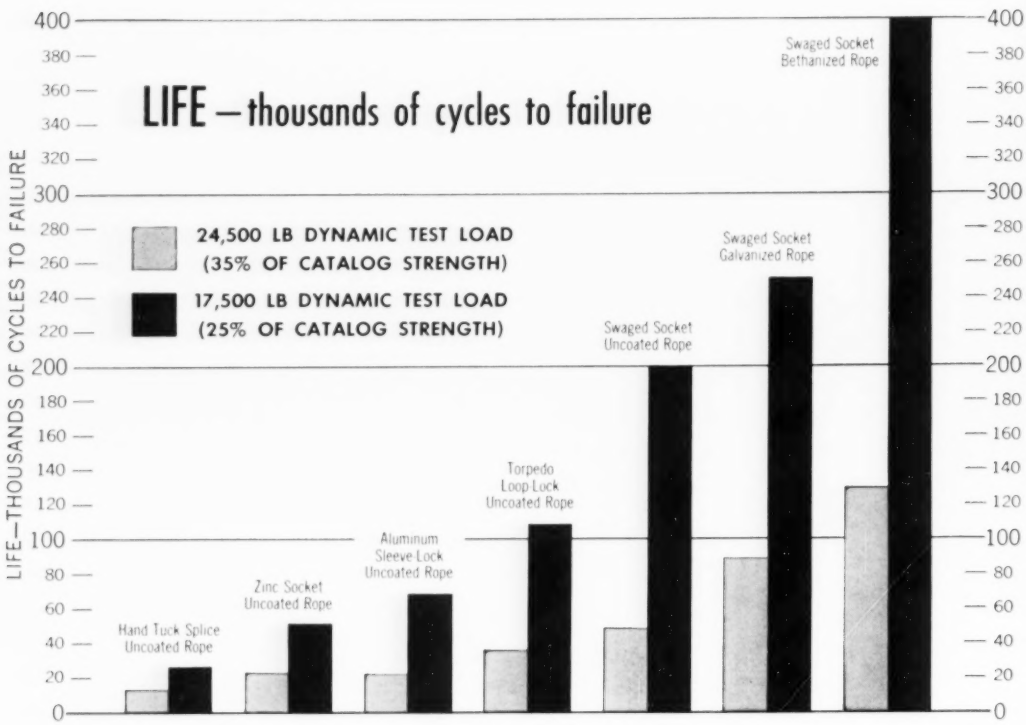
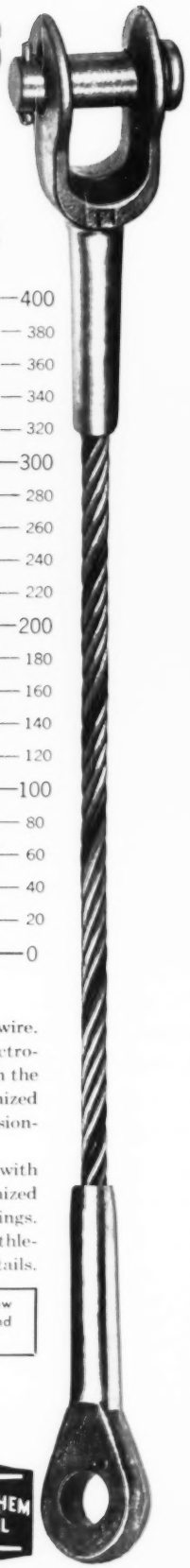
# TWO-YEAR STUDY REVEALS FACTS ON BOOM PENDANTS

## Swaged socket proves best in exhaustive torture-tests



More than two years ago, Bethlehem began a research program to determine: (1) the type of end-fitting that would best prolong the life of pendants, and (2) the kind of wire rope that would stand up longest in this service.

Field research was carried on simultaneously with gruelling laboratory tests simulating field conditions. This research was wholly objective. Our purpose was to find *answers* . . . not to confirm preconceived notions.

The dynamic tests convinced us that the swaged socket is best by a wide margin. These tests were cruel, impartial. They showed that in dynamic holding-power, the swaged socket is unsurpassed. They also revealed a less obvious fact: that the swaged socket *distributes* the stresses occurring in the rope near the terminal fittings, instead of creating points of stress concentration. Result: longer pendant life.

The rope designated "Bethanized" in the above graphs was constructed of redrawn bethanized wire. The uniform, ductile zinc coating, applied electrolytically, acts as a cushion and lubricant between the wires in boom pendant service. Moreover, bethanized rope has the added advantage of high corrosion-resistance.

As shown by the graphs, bethanized rope with swaged sockets far outperformed hot-dip galvanized and bright ropes with various types of end-fittings. For further information, write or call us at Bethlehem, Pa. Our engineers will gladly give you details.

When replacing your present pendants or buying new equipment with pendants, specify bethanized rope and swaged sockets.

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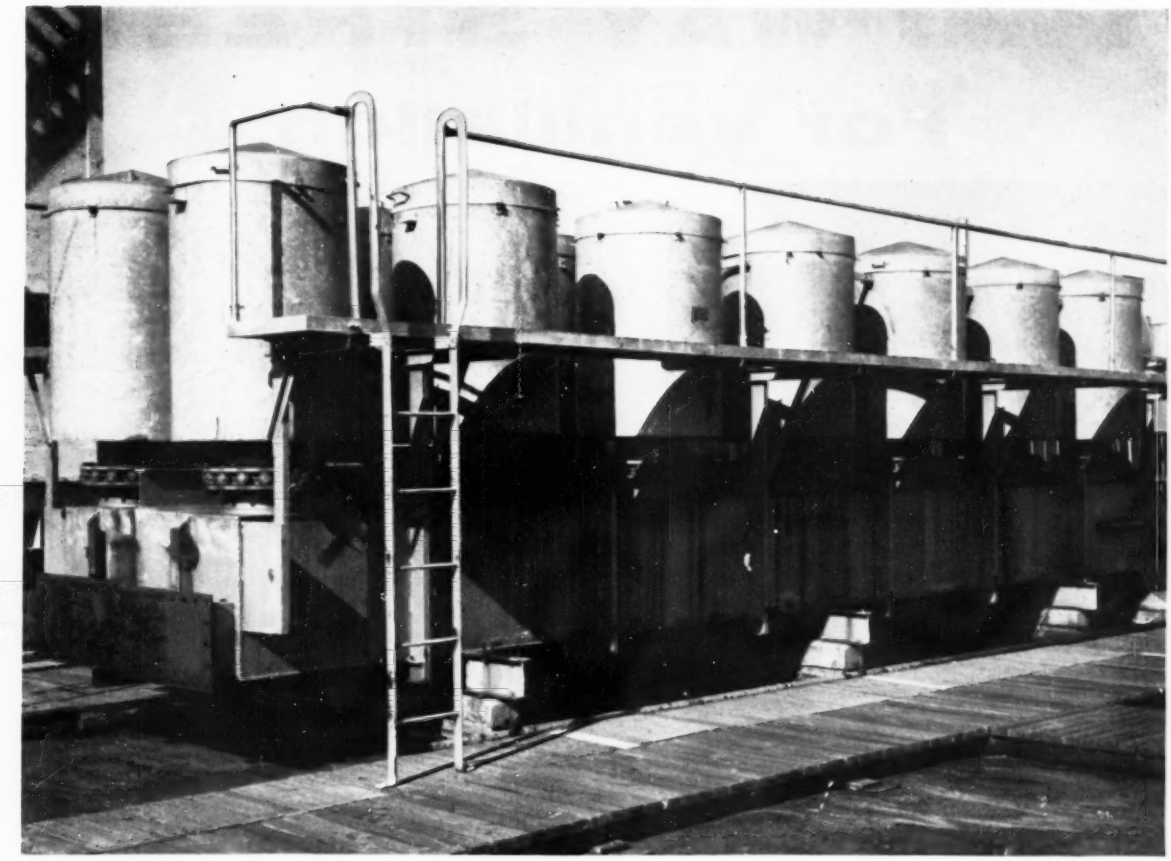

Staynew air-intake filters control intake-processing air at E. R. Squibb Division of Olin Mathieson Chemical Corporation.

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# Squibb Finds Staynew Filters Economical, Reliable

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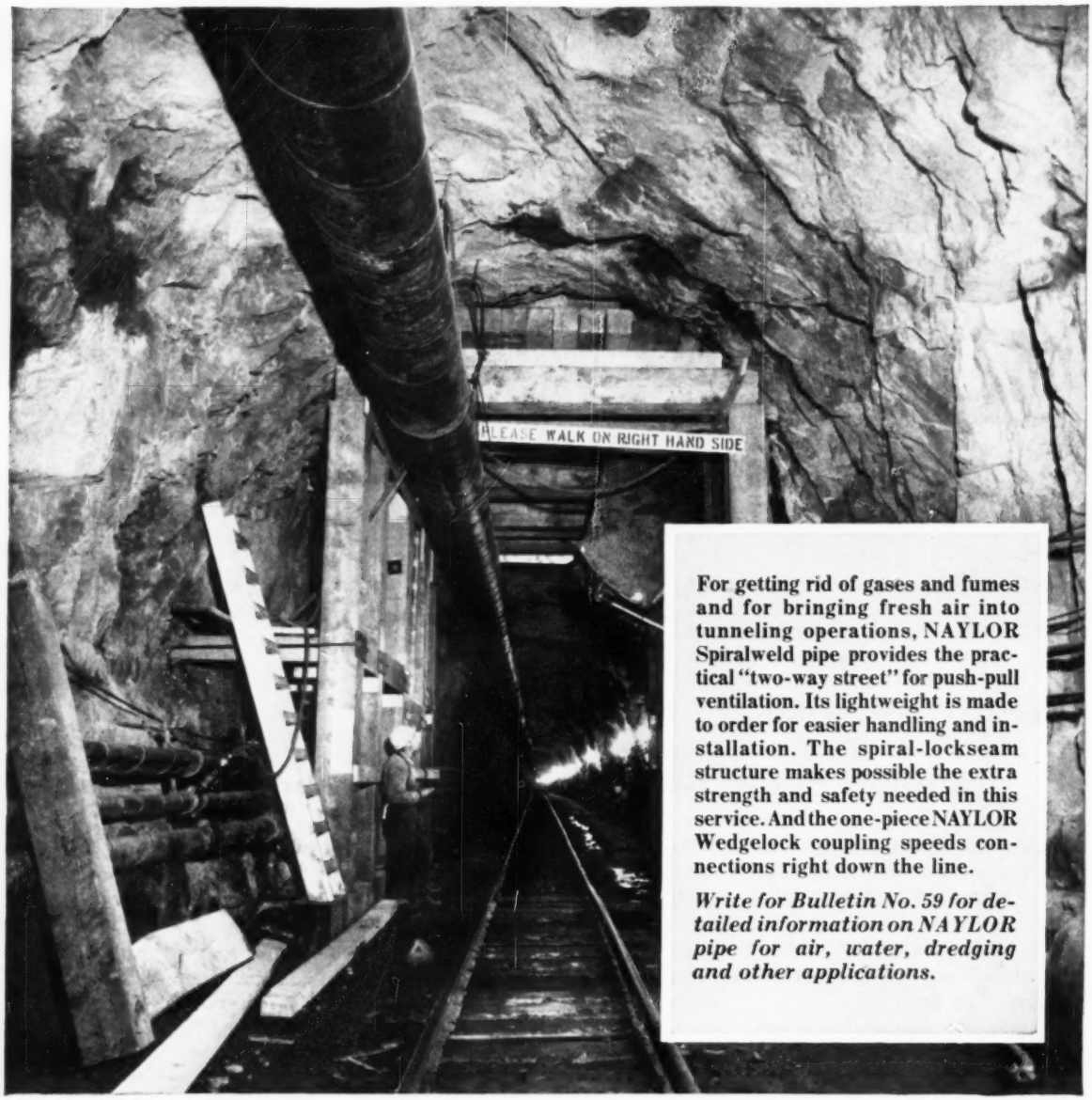
# TWO-WAY STREET
## For Ventilation

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# Compressed Air Magazine

*Founded 1896*

VOLUME 64 NUMBER 3

**March 1959**

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**ON THE COVER**

MARCH is traditionally the windy month; it could be called the power month. Windmills, an old means of producing power from the wind, are reappearing—but with a new look. The one above was built by Automatic Power, Inc., as a part of a wind-driven power package that can be used in remote areas, operating unattended for many months. Its unique blade design, mounted on top of a 33-foot-high tower, permits electric power generation at wind velocities of as low as 6 mph; the maximum output is rated at 6 kw. *Something About Windmills*, on page 26, tells more of this unit, and gives a historical thumbnail sketch of its prototypes.

## FEATURE ARTICLES

Page 12 **An Investment In A Landmark**—*S. M. Parkhill*
The seat of New York City's local government is built on a site rich in early American history. The structure, begun in 1803, was completed and then allowed to fall into disrepair. This article traces the background of the building and describes its recent complete restoration which cost nearly $2,000,000.

18 **Air Guns, Part II**—*G. R. Smith*
Modern air and gas guns are the subject for this article which concludes a history of such weapons. The Daisy air rifle and the three main U. S. builders of air and gas guns are discussed, along with primary European manufacturers.

22 **Concrete Batching**—*H. J. Miller*
Compressed air has entered the field of ready-mix concrete and is helping to solve some of its most perplexing problems. A Florida firm's experience is detailed.

24 **Aerated Antifreeze**
Winter's low temperatures often mean that construction work on lakes and rivers must cease because of ice. A Canadian builder overcame this problem by using underwater aeration to prevent freezing around a 4-lane bridge.

25 **Compressors Simulate Road Conditions**
Two high-pressure compressors have been put to work by a division of a large automobile manufacturer to supply realistic road conditions for automatic testing of air suspension systems.

29 **Golden Beaver Awards**
The Beaver's, an organization of heavy-construction men, announces its annual awards in each of five categories.

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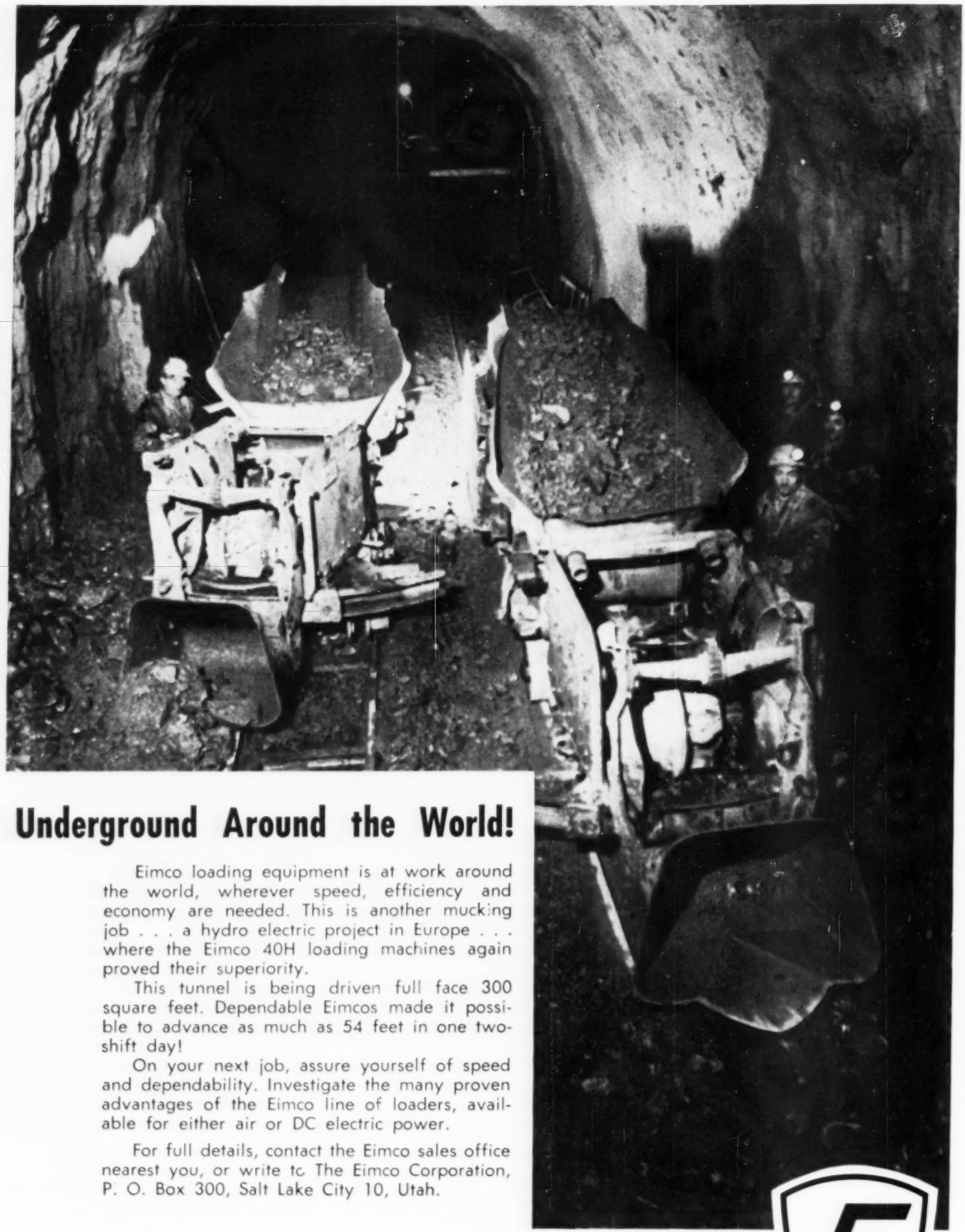

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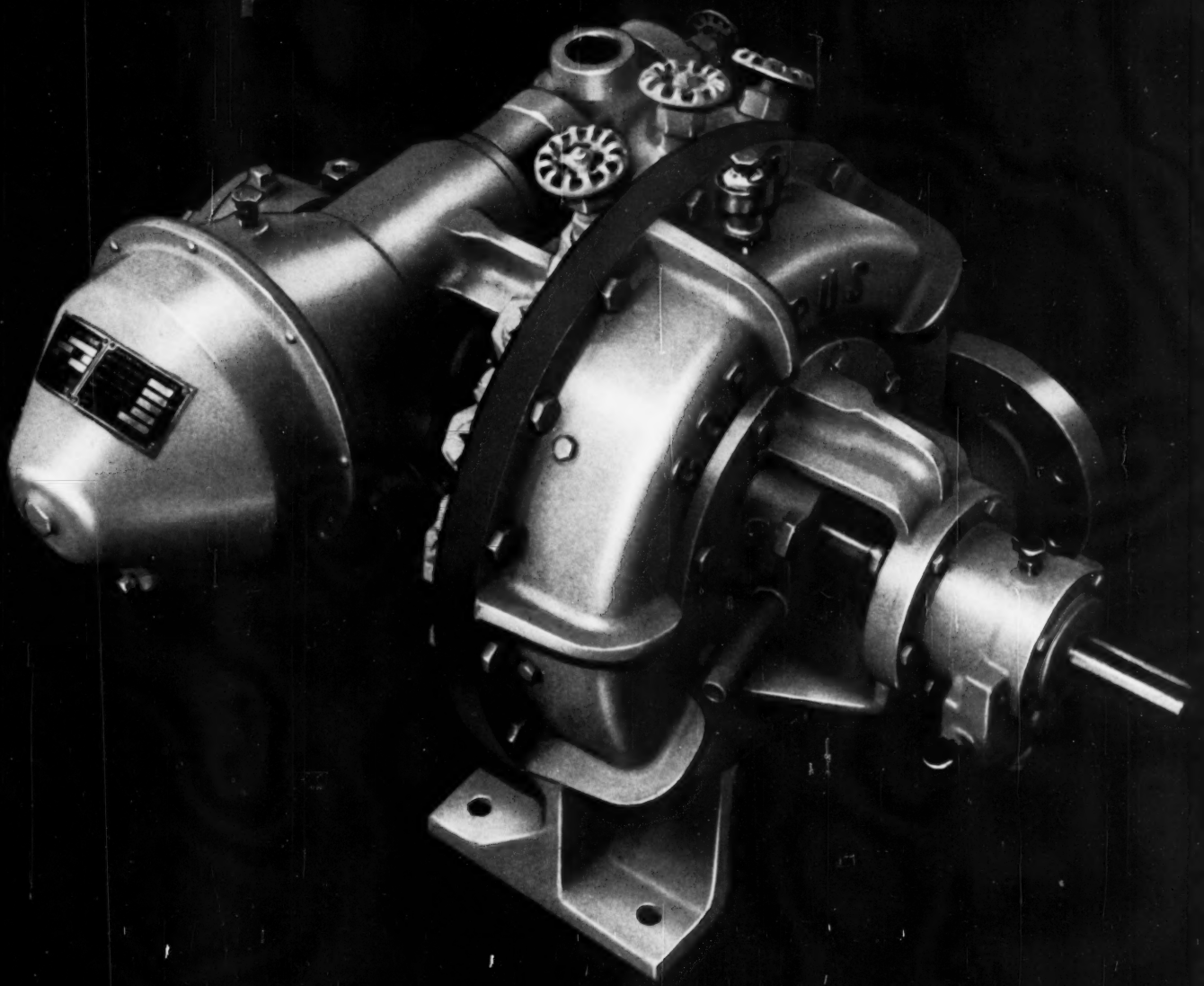

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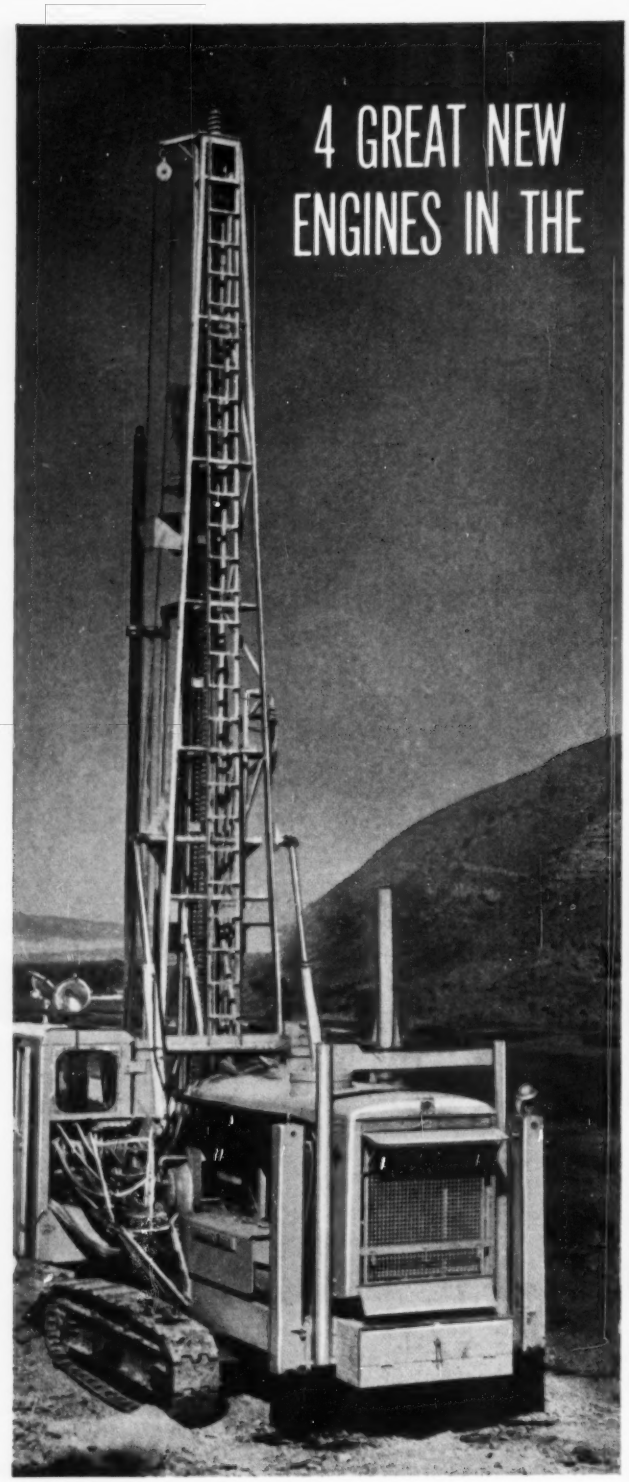

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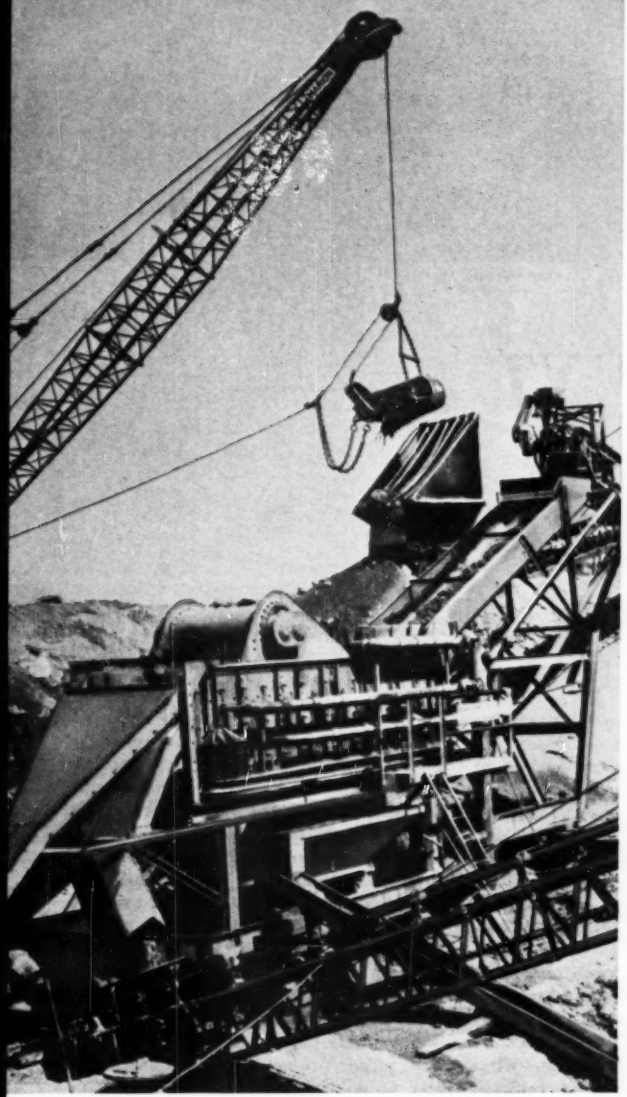

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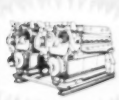

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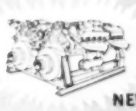

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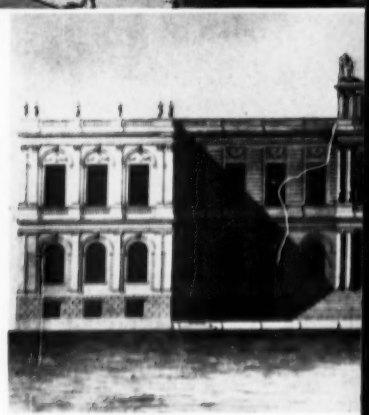
# *AN INVESTMENT IN A LANDMARK*



MORE than 3 centuries ago, Peter Minuit, Governor of the Dutch West Indies Company, made what was to become one of history's most famous bargains when he purchased the island of Manhattan. Since the building of his small Fort Amsterdam near the present Bowling Green, New York has grown into the world's largest city. Like every town, New York has its city hall; and like most, it is made of stone.

The original construction began in 1803 and was finished 9 years later. At the time, the population of New York was slightly more than 97,000, most of it concentrated on the southern tip of the island. In the years that followed, relatively no care was taken of the structure. It became an eyesore, and proposals to have it razed were frequent. At various times, plans were even made to erect another home for the city's administration farther uptown, where the center of activity was moving with the increasing population. In relatively recent times, proposals to replace the building were submitted as a part of the downtown development program. "Too many cherished associations" prevented it each time; and for this reason, City Hall was recently restored.

THE history of City Hall began when the architectural drawings of Joseph F. Mangin and John McComb, Jr., were accepted. Of the many plans submitted, there was little question about the one to be chosen. Mangin and McComb had incorporated in their design what the people of Gotham most wanted: "The handsomest structure in the United States . . . something for all ages."

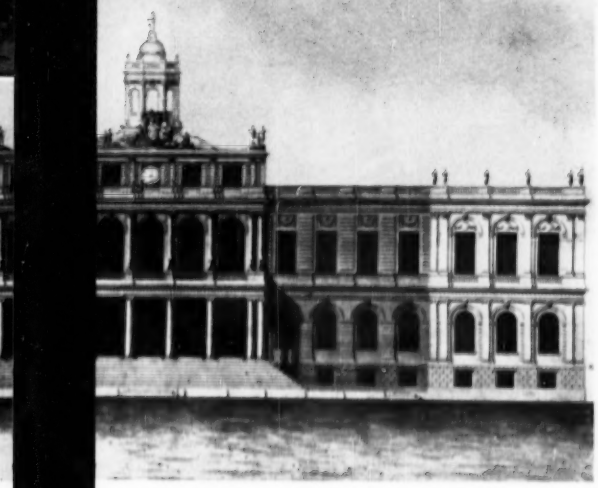
Mangin had a minor role during the construction phases as compared with his associate. McComb is generally given credit for the project. He was more than an architect for City Hall. He was active in many phases of the construction, including the engaging of his own quarry. Further, to assure a steady flow of marble to the worksite, he even supported those firms that were concerned with road maintenance between New York City and Stockbridge.

The first appropriation for the project was $25,000, and the cornerstone was laid in May 1803. (During the restoration job, the cornerstone was never found, although the most scientific and modern electronic detection equipment was used in the sleuthing.) McComb did not have an easy task ahead, for like so many persons who are concerned with public projects, he faced the problem of a committee that wanted the best for the least possible expenditure. Corners had to be cut. For more than a century, the most obvious of these cost reductions was the use of brownstone on the rear of the building, rather than facing the entire hall with Massachusetts marble. During the refacing job, however, other means of saving

### RESETTING A GEM

The sketch below was drawn by Joseph F. Mangin and John McComb, Jr., and was accepted by the people of New York from many plans submitted. Although it looks much like City Hall does today, it was impossible to tell whether it was a part of the working set of plans or not. The original drawing is in the archives of the New York Historical Society. The picture at the left was taken from the southeast corner of the building and clearly shows the web of scaffolding that was required during the restoration. The illustration at the the right shows the front of City Hall as it looks today. In front of the entrance lies City Hall Park. To the left, and out of sight, is Broadway; to the right, Park Row—the two streets that bound the Park on its southern two sides. City Hall forms the third side of this triangular plot.

PHOTO, DEPT. OF PUBLIC WORKS



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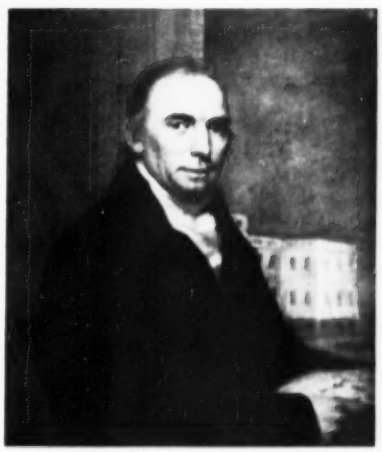


### THE ARCHITECT

The photograph, left, is a reproduction of a painting of John McComb, Jr., who is generally given credit for being the architect of New York City Hall. Not only were his plans accepted, but he was also directly concerned with other phases of the construction, from logistics to quarry operations.

PHOTO, DEPT. OF PUBLIC WORKS

money were uncovered, and many of these were ethically questionable. Between the inside and outside walls, for example, the contractors discovered lime mortar and all varieties of rubble fill. From the window sills to the floor, that portion of a building known as the window apron walls, there was nothing between the outside stone and the lathed plaster interior but wooden studding. These crevices had to be filled with brick during the reconstruction.

The work progressed slowly for 4 years and McComb had to cope with not only the severe winters, but sickness and low morale among the men.

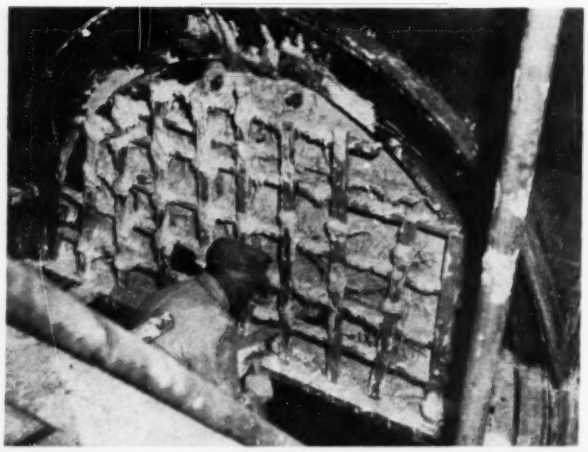
Enthusiasm was restored when the copper roof arrived from England at a cost less than the original estimate of $10,000. City Hall was finally completed for occupancy on August 12, 1811.

The ensuing years saw many attempts to preserve the building, interspersed with plans to buy City Hall by other agencies. Less than 20 years after the structure had been dedicated, the Federal Government proposed to purchase it and the adjacent park as a customs house. The plan was rejected, as were all the others.

In 1847, the first attempt at a preventive maintenance program was made. The interior was repainted, the dials of the clock were regilded, the roof was replaced and the outside was repaired, at a total cost of $18,000. For the next 10 years the building was kept in fair condition. After a fire, resulting from a celebration commemorating the completion of the laying of the first Atlantic cable in 1858, destroyed a wooden statue of Justice that rose from the cupola, the building depreciated faster than it could be repaired. (Justice was not replaced with the present copper figure until 1888.) The Hall became black and the windows were partially boarded.

In 1895, another attempt was made to move the structure farther uptown; the plan was abandoned in favor of a recleaning. However, during the following 5 years, renovations followed no set pattern. Money was obtained from interested wealthy individuals, each of whom specified how his contribution was to be spent. Paraffin and sandblasting were applied to the exterior, with little noticeable results. Portions of the interior received some superficial painting.

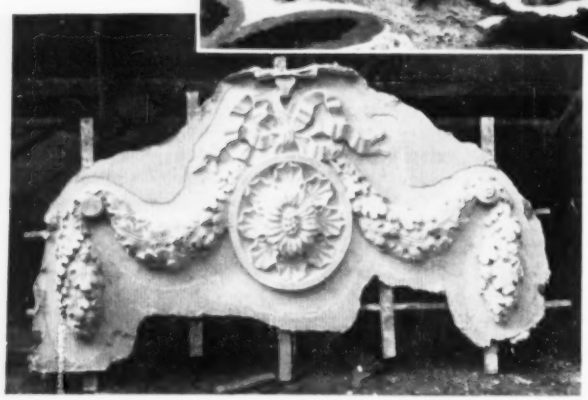
WHEN the Post Office was torn down in 1939, City Hall could be viewed from lower Broadway, across its park, as the architects had originally intended. City Hall Park is one of the oldest in New York, having been acquired as public land in 1686 under what is known as the Dongan Charter. Vlacte (Flat), Second Plains, The Common, The Fields, The Green, The Square and The Park have been some of its many names. Through the years, City Hall Park has served as a sports field, a site for public execution, a parade ground, a jailhouse



## MAKING THE CAST MODELS

Before casts of the architectural details of City Hall could be made, the best preserved sections were selected. Then a plaster shell was placed over the area to be reproduced, and hot glue poured into it. This filled every carved feature. Then, the shell was removed (left). Below the picture can be seen the glue mold being peeled away, ready to be used to make the plaster model. The mold was replaced into the plaster cast (below) for support; and plaster, strengthened with burlap, was gradually poured into the mold. A wooden frame was next placed over it to give it additional rigidity. When the plaster had hardened, the cast was carefully removed from its supporting shell, the glue mold adhering to the casting. Next, the glue mold was pulled away (center). (The man looking on is the master molder who is inspecting the piece for imperfections.) The finished plaster cast, to be used as a model for carving, is shown at the lower left; and the carved stone of medalions and oak leaf swags over a window of City Hall is shown, as it looks today, at the bottom right.

PHOTOS, DEPT. OF PUBLIC WORKS



**STONE CUTTING**

One of the original Corinthian capitals of City Hall is pictured (left) and clearly shows the signs of deterioration that made the restoration of City Hall necessary. Before the plaster models could be made, the areas that had eroded away on this column had to be replaced with clay. After the plaster model was made, the first step in reproducing the Corinthian capitals was to cut the stone to rough shape by machinery preparatory to carving (top, right). Then, guided by a plaster model, the carver at the right laid out the work with a pointing machine. Faithfully reproducing the original, the capital begins to take shape, eventually emerging in full detail of Acanthus leaves (bottom). These views were seen in Republic Stone Corporation's yards in Brooklyn, N. Y.

PHOTOS, DEPT OF PUBLIC WORKS

location and a popular gathering place. Together with City Hall, it has been the site of many nationally important and civic celebrations—the repeal of the Stamp Act of 1755, the evacuation of British troops, the laying of the first Transatlantic cable and the receptions of victorious generals, visiting statesmen and reigning monarchs, to name a few. City Hall itself has always been the office of the Mayor of New York.

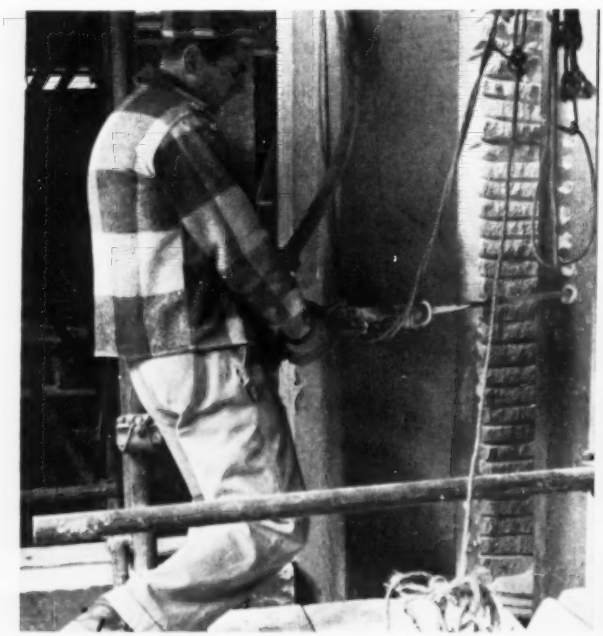
With the Post Office removed, the view Gotham's citizens had was the first like it since 1875, and they were ashamed of what they saw. Enthusiastic restoration support began, headed by the Downtown Manhattan Association (formerly the City Hall Park Association). In its plan to relandscape lower Manhattan, provisions were made to repair the carvings and stonework that were once so attractive on City Hall. These had become not only unrecognizable, but were a potential hazard.

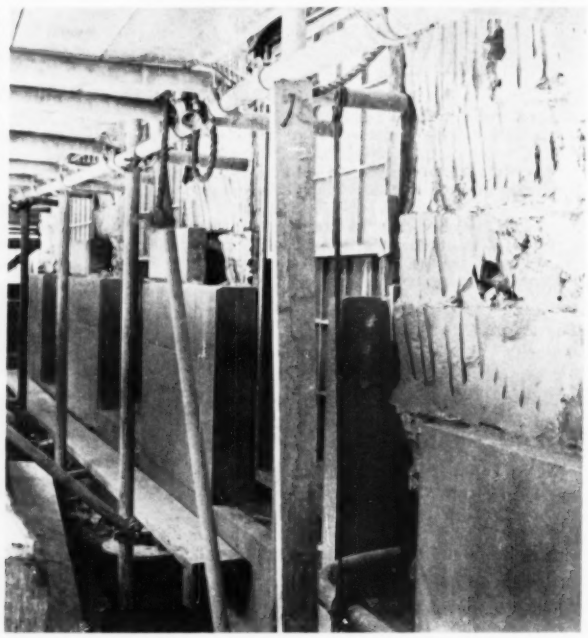
Mayor Robert F. Wagner, while he was still Chairman of the City Planning Commission, was very active in efforts to have something done about the condition of City Hall. Funds for the project were appropriated from the Capital Budget in 1948; however, during the Korean incident, the money was turned to civil defense. In 1954, the money was reappropriated and the work began. Mayor Wagner was given the annual Gold Medal Award of the Downtown Manhattan Association for his efforts and enthusiastic support.

PHOTOS ALBERT ROTHSCHILD STUDIOS

## HOW TO SHAVE A BUILDING

These three pictures were taken during the reconstruction of City Hall. The one directly below shows a worker using an Ingersoll-Rand J-30 Jackhamer to line drill around a window. Air was furnished by two 315-cfm I-R Gyro-Flo rotary air compressors on the ground below. Air was supplied to the drills at a nominal 100-psig pressure through the piping in the scaffolding. At intervals, connections were provided for outlets to the tools. One of these is shown at the right. To replace the stone that was removed, 15,000 blocks had to be fastened to the original building. This was done by at least two bronze pins in each. The photograph reproduced below (right) shows a portion of the new stone, above which the familiar parallel drill pattern of line hole work can be seen.





The first allocation for the project was a sum of $2,250,000, and the job was advertised for bids. Three alternative plans were offered. In the first, the brownstone and stucco at the basement level along the front (south), and the east and west wings, was to be replaced with Missouri red granite. That marble which had eroded was to be replaced with limestone. The columns at the main entrance, as well as along the entire periphery and the area the columns supported the balustrade, and the main entrance steps were to be removed and replaced with limestone. To execute this plan, the free standing columns at the main entrance would have to have been removed temporarily, turned and reset with the original interior faces outward after new capitals and bases were provided. The second scheme was similar to the first. It included, however, the replacement of all marble on the three sides with limestone, including the main entrance columns. The third proposal required the replacement of all the outer stone. It was this last, at a bid of $1,956,800, that was accepted.

The architectural firm of Shreve, Lamb & Harmon, Associates, was commissioned to make a condition-and-cost survey, and to work with the contractors, Republic Stone Corporation and United Stone Works, Inc., under the direction and coördination of the New York City Department of Public Works and Commissioner Frederick H. Zurmuhlen.

TO DO the job as accurately as possible, a considerable amount of record checking was necessary. The original plans, as retained by the New York Historical Society, were first read, but were found to be of little value for they did not represent actual conditions of the exterior. Investigation was then made with the Works Progress Administration's drawings and actual on-site measurements were taken. Although the original drawings were numerous and of magnificant detail, the architects and contractors found that it was impossible to tell which drawing had been used for the 1803-12 construction work—none had been marked accordingly.

Investigation at the site showed that there was little damage to the mass of stone, but that the joints and roof line were in pitiful shape as the result of severe weathering. At the northeast corner of the building, near the roof, the wall was out of line. All the windows were out of level and plumb, as was the entire building. Areas where McComb had sacrificed craftmanship for cost reductions had to be corrected.

Because of the bonded nature of the

walls, it was impossible to remove all of the outer stone without endangering the structure. It was decided to shave away 4 inches of the stone casing and replace it with new stone that would look as much like the original as was possible. (The original stone casing varied in thickness from 5 to 18 inches.) The walls were approximately 4 feet thick. They included the outside of marble; an inner wall, of rubble stone; and the space between that was filled with rubble of all sorts, some limestone and mortar, but no cement. In the areas that were out of line at the northeast corner, the slice of remaining stone was temporarily pinned with steel dowels to the inner wall face.

The original exterior surface was brownstone at the basement level, as was the entire north facade; and the rest was of Massachusetts marble, as we have indicated. To replace it with stone similar in coloring and as durable as possible, unpolished Missouri red granite was selected for the basement level, and Alabama veined limestone was picked for the upper portions, including the north facade. This was one way in which the restoration work varied from the original. Other modifications were made, although all changes were kept within the Renaissance architectural style of the original Hall.

A 3-sided stairway on the north side was removed because it was considered unsafe. It was replaced with steps rising along the walls of the building. These were equipped with a wrought iron handrail for added safety. Other changes included the conversion of the entrance to the basement, to the left of the steps, into a window to balance in design with the window on the right-hand side. A doorway was cut through the north side of the steps, and another entrance on the south side was eliminated in favor of a window. East and west entrances were repaired by replacing worn woodwork with granite to match the rest of the basement stone.

As work progressed, one of the major problems that developed was how to fasten the new stone to the old. There were 15,000 individual stones used in the refacing job. Two or more bronze anchors, in each piece, set at an angle into the old inner wall, were the solution.

To strip the old stone, fast-drilling Ingersoll-Rand J-30 Jackhamers were used. These lightweight, balanced instruments worked downward, at a slight angle, drilling in a line hole pattern. Rather than blasting, the outside stone was removed by the plug-and-feather method. The feather, a strip of iron with a cross section like a half moon, is placed in the hole. A second is placed beside it so that the arcs of the feathers go around the hole and the straighter edges are next to each other. Then a steel wedge, or plug, is placed between them. This is driven in by repeated blows of a hand-held hammer. Pressure is built up as the feather is forced into the stone until the rock fractures. In this way, the stoneworkers can "feel" the coming break, and the results are more uniform and accurate than is possible with blasting methods.

Air was supplied at a nominal 100-psig pressure by two Ingersoll-Rand 315-cfm portable Gyro-Flo rotary compressors. It was fed through piping around the scaffolding. At regular intervals in this pipe, there were air outlet valves at which points the ¾-inch air lines from the J-30's could be attached. In this manner, the contractor assured a ready supply of air at any area of the building.

While this work was being done in Manhattan, across the East River in the contractor's yard in Brooklyn, new stone was being prepared by methods that have remained essentially the same for centuries. The care and precision that was taken was equivalent to that used by restorers of artwork. Molds and plaster casts were first made of the best preserved ornamental elements at City Hall—the acorns, oak leaves, swags and Corinthian capitals—to assure positive accuracy. These were used as models for the preparation of the stone.

The copper cupola that had replaced one destroyed by fire caused by repairmen in 1917 was restored. It was given three coats of paint. After the final application and before the paint was quite dry, the surface was sprayed with pulverized limestone. The resultant color matched that of the rest of the stone quite closely. After other sections of the roof had been made weathertight, they were covered with a vinyl plastic so as to preserve the color relationship between the center and the two wings.

The inside of City Hall was also restored. Steel supports replaced rotten wooden timbers, chimney flues were sealed, and the steps of the famous hanging stairs were rebuilt. Painting was done throughout by Pelham Painting Company, Inc. After the work was finished, City Hall had a rededication that began on July 13, 1956, and lasted 10 days. A special restoration exhibit was placed in the museum.

With the job finished, considerable thought has been given to further preservation of City Hall. To keep the pigeons away, a low-voltage, electric pulsating system was installed by Electrepel, Inc.; and to prevent other staining and deterioration, the surface will be covered with a preservative. This will be done in about 1961 after the new stone has had a chance to thoroughly dry. The building will be cleaned of any dirt and grime that have accumulated, and then the preservative will be applied. This future preservation is estimated to cost approximately $10,000. Since it will be repeated every 5 years, the expenditure averages $2000 annually—a maintenance figure that is small compared with the original reconstruction investment of $2,000,000.

PHOTO, DEPT. OF PUBLIC WORKS

**IN THE INTEREST OF SAFETY**

Once this stairway was a 3-sided unit without handrails. It rose steeply on the north, or back, facade of City Hall. During the restoration, it was changed to this 2-unit piece and wrought-iron handrails were added. A door was then placed in it and the old door to the basement, to the left, was changed to a window similar to the one at the right. All of these changes, as were the others that were made, were in keeping with the Renaissance architectural style of the building as planned by the architects.

# Air Guns

## *Part II*

G. R. SMITH

THE STORY of Daisy air rifles began not with air guns but with watches and windmills. While working in a jewelry store in Plymouth, Mich., Clarence J. Hamilton got the idea that the windmills of that time (1882) should be made of iron instead of wood. He patented a metal windmill and his product caught on so successfully that Hamilton turned to new areas; all the toy guns of the period were made of wood, so he again applied the idea of using metal. The company began producing a few of the toy weapons as a sideline, and they proved more profitable than the windmills. Soon the company left the wind machines for toy guns exclusively. It was one of the first in the field to concentrate on advertising and promotion. In 1889, the company sold 86,400 of the air rifles; by 1952, sales had grown to 1,285,001. At times during the firm's history, China, Great Britain, South Africa and Australia have been the countries importing the most Daisy products.

While some men were busy designing small air arms, others were at work on larger pneumatic weapons. As early as the 1400's, Leonardo da Vinci had made sketches of a "steam cannon." In the early 1800's, an enterprising inventor named Jacob Perkins, Newburyport, Mass., developed a rapid-firing steam gun. He achieved pressures as high as 900 psig to fire projectiles through ¼-inch iron plate, or through eleven 1-inch planks. By 1824, he had the gun perfected so that it would fire 1000 shots per minute. But eventually the development of the more convenient gunpowder cartridge spelled the end of the Perkins weapon.

In 1883, the first of several huge pneumatic guns was developed to fire large shells containing high explosives, such as dynamite. The gun was manufactured by an Ohio man named Mefford and was tested by a Lieutenant Zalinski of Fort Hamilton, N. Y. It was a brass tube, 2 inches in inner diameter, 28 feet long, with a reservoir at its base that contained 12 cubic feet of air at about 500-psig pressure. It had a range of some 2100 yards with respectable accuracy. Later, 40-foot-long guns of this general type were built and installed on a U. S. Navy ship named *Vesuvius*. The famed cruiser, which saw action in the Spanish-American War at Santiago Harbor, Cuba, in 1898, carried three of these guns fixed in her bow. They fired projectiles 14.75 inches in diameter and about 7 feet long. As in the Napoleonic forays, the weapons' worst damage inflicted seemed to be psychological; its chief disadvantage was the difficulty of aiming the fixed guns. The *Vesuvius* was more successful as a subject for newspaper copy than for marine warfare, and orders for more like her were cancelled.

Modern compressed air shoulder and hand arms consist of two types: *pneumatic guns*, that have equipment for pumping and storing air; and *spring-air weapons*, that use an internal spring-actuated plunger to produce power. It is interesting to note that because of the freedom from regulation of arms, the pneumatic pump-up type, that can produce great power, has been more thoroughly developed in the U. S. On the other hand, the spring-air type, which can have its velocity designed to be below firearm speed, has been more refined in Great Britain and Europe, where arms are regulated.

The Wissler Instrument Company, St. Louis, Mo., wrote the opening chapter to contemporary pneumatic weapons in the United States in 1882 when it was solicited to manufacture an air rifle pat-

**POPULAR SPORT**

At the left, the popularity of shooting with gas weapons can be seen by the group at this teenage match. Air and gas guns' short range makes them safe. They are highly accurate within their range and inexpensive to operate.

ented by Walter R. Benjamin. The instrument firm was the predecessor of today's Benjamin Air Rifle Company. The rifle was pumped up by placing the muzzle toward the ground and holding a muzzle-end pump rod between one's footgear. The rifle was lifted up then pushed down to compress air in a chamber below the barrel. About three or four strokes were required to fire the BB shot or darts. Benjamin has remained a leader in the business since it pioneered the sport.

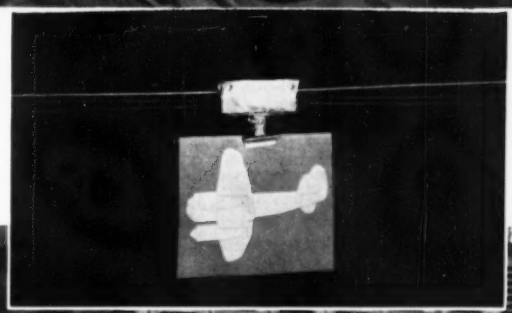
The firm that has probably done the most to popularize air gun shooting in the U. S. is the Crosman Arms Company of Fairport, N. Y. Crosman, like Benjamin, builds a comprehensive line. The firm is known for its vigorous advertising and research programs and its widespread sales and service organization.

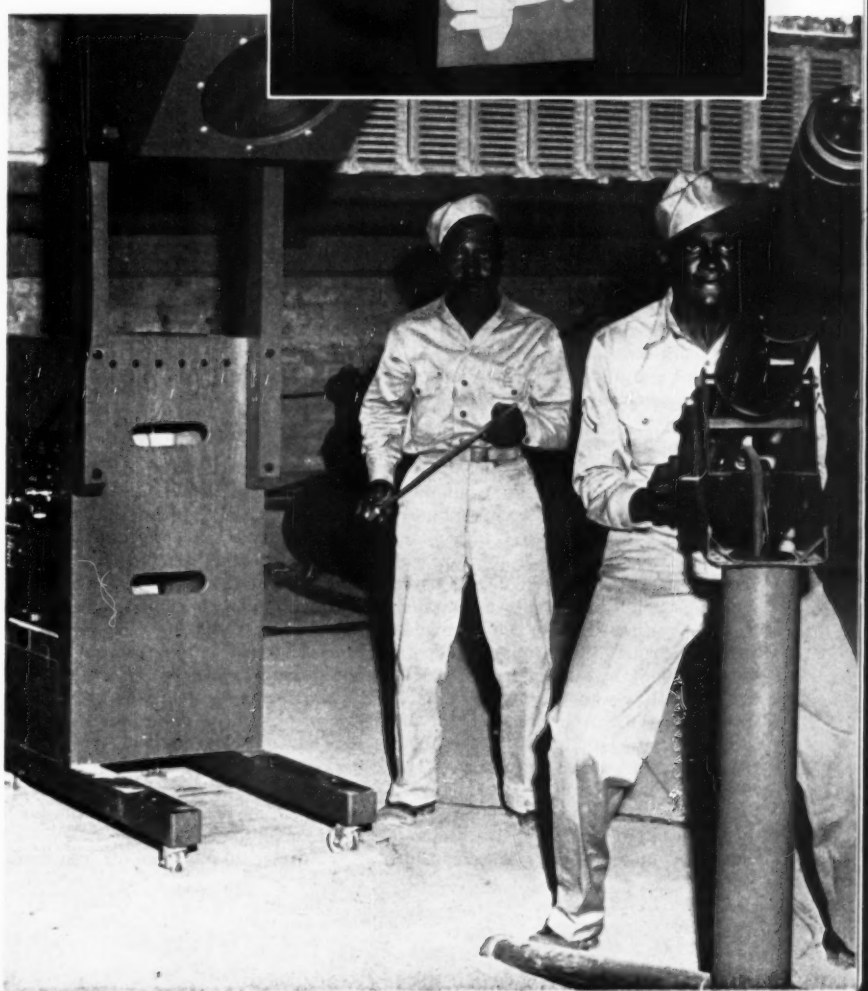
Sheridan Products, Racine, Wis., is the third of the three United States firms that currently build pneumatic rifles. This company makes quality arms with the most penetrative ability and the greatest accuracy of any in the country.

This pneumatic (pump-up) type of weapon has several advantages. There is no recoil; and its length is short compared with spring types, because the air chamber can be located below the barrel. Its weight is light because there are no springs, and heavy construction is not required to dampen recoil. The pump-up feature permits great power, as the gun's pressure depends on the number of pump strokes. There are no springs to wear out, and operation is generally easy, as this type is pumped by pulling back an arm that pivots near the forearm, allowing great leverage to be developed.

There are disadvantages to this weapon too. Several pump strokes are necessary for one shot and all air is expended with each firing. To obtain consistent results, pump strokes must be of the same number and strength so that the air charge will always be the same.

Benjamin selected the St. Louis in-





**WARTIME TRAINING**

During World War II, the U. S. Army Air Force and Navy used air-powered machine guns for training. At the immediate right, a potential gunner fires one of the weapons at an aircraft silhoutte (inset) while a loudspeaker provides battle noises. In the picture at upper right, a vice-president of the company that built the air weapons tries his hand.

**GAS-POWERED PISTOLS**
It didn't help win the West but today's gas-powered "6-shooter," at the left, can fire three times that many shots, using BB's. More conventional in appearance for a gas pistol is the Crosman Model 150 shown below.

strument firm to build the weapon because, though simple in design, the gun demanded precise manufacture. The gun's muzzle-end plunger worked like an ordinary bicycle pump, but with much closer tolerances. With each stroke, a valve was forced open to receive the air. The valve closed by a spring when the stroke was completed. The pull of the trigger caused the depression of a pin that opened the air chamber and the air rushed ahead, forcing the projectile out the barrel.

Although slow in starting, public acceptance of the weapons increased, and Wissler continued to manufacture them until 1926. The company changed hands at this time; A. P. Spack, Sr., purchased the entire business and he runs it today. At the time of the change, the instrument business was sold and the company adopted the name of Benjamin Air Rifle Company. The firm introduced the first pump-up air pistol in 1933, and today produces both compressed air and carbon dioxide weapons. Other companies have used many ideas from expired patents once owned by the Benjamin company.

Crosman Arms Company is the largest manufacturer of air and carbon dioxide guns in the world, but its beginnings seem quite modest. The company grew out of the Crosman Seed Company of Rochester, N. Y. A corporation was founded in 1925 to build a gun using a pump principle hit upon by a chauffeur of the Crosman family, which owned the seed firm. The original weapons were excellent in quality but so costly that few sales were made. Philip Y. Hahn, Sr., the current president of the company, purchased it in 1940 for $5000. He had been sales manager from 1925 to 1930. Few of the guns were sold during World War II (although 2000 went to the OSS), but after the war the company prospered under Hahn's salesmanship and the technical skill of chief engineer Rudolph Merz. Today the company has its own plant with 100,000 square feet of working space and more than 100 employees. The plant is completely mechanized and utilizes compressed air for control of machining and drilling. It has 6-spindle automatic screw machine equipment, electronically controlled stock-carving machinery and many other automated processes.

The company's annual sales are approximately $2,000,000. The major portion of business comes from sales of carbon dioxide weapons in which a gas cartridge replaces pumping, most Americans apparently prefering to pay for the small gas capsules instead of expending pumping effort. Crosman has set up an extensive dealer repair service and promotes shooting throughout schools, camps and industrial concerns.

Youngest of the large air gun manufacturers in the United States is Sheridan Products Inc., founded in 1947. These rifles are the quality air weapons built in the United States and are more expensive than competitors'. When the Sheridan rifles were first produced, their quality was so high that their expense was twice the other two makes. Stocks were of the best walnut; the barrels were of a costly corrosion-resistant phosphor-bronze instead of steel tubing. Valves were of chrome steel; the compression chamber (capable of containing 1500-psig pressure) and the valve were formed as a unit. E. N. Wackerhagen and his chief engineer, I. R. Kraus, developed their own special bullet of .20 caliber. The bolt-operated rifle had variable power and two strokes on the forearm pump created a bullet velocity of 400 feet per second. Twelve pump strokes raised this to 770 feet per second. Later models have less expensive hard

brass barrels and impact valves, and the Sheridan is described by an arms expert as being the best pneumatic rifle manufactured anywhere.

Except for the Daisy weapons, and a pistol manufactured by the Hy-Score Arms Corporation, Brooklyn, N. Y., almost all spring-air guns are of European manufacture, most of them being produced in Germany and Britain. Hy-Score sells four models of spring-air rifles imported from Germany, where more than a dozen comparatively small arms firms produce custom-quality weapons in the tradition of European gunmaking. Often these are precision weapons that are utilized for match shooting in a vein somewhat more serious than the pleasure shooting popular in the United States. One of the most respected of these is the Walther company (Carl Walther Sportwaffenfabrik, of Ulm and Donau, Germany). An indication of their quality is evident from the fact that no Walther guns are stocked by the one U. S. distributor, all weapons being made to order.

Three companies make spring-air guns in Britain: Birmingham Small Arms Guns, Limited (BSA), and the well-known firm of Webley & Scott, Limited, both of Birmingham, England; and a Scottish company, Millard Brothers, of Lanarkshire. BSA is Great Britain's largest arms producer and manufactures several models of production air rifles. Webley & Scott not only makes a line of high-quality rifles but also is the only British producer of spring-air pistols. These guns have their parts machined carefully and are said to have workmanship equal to the finest firearms. The Scottish firm makes a rifle called the Diana. This weapon is very similar to the rifle that Hy-Score imports.

Except for an air gun that is being marketed by the Swiss firm of Hämmerli, all current carbon dioxide-powered gas guns are built by Benjamin and Crosman. These weapons, because of the convenience of merely inserting a gas cartridge, make up a large portion of the companies' sales. European manufacturers have been hesitant to enter the field because they believe their spring-air guns have been developed to a fine degree and have shooter acceptance. Also, shooting costs are lower with the spring-air types, and accessibility to carbon dioxide cartridges is not as widespread in Europe as in the United States.

Carbon dioxide makes an ideal propellant because of its colorless, ordorless and nontoxic qualities. Further, within the cartridge that is pierced to supply the gas pressure is a quantity of liquid $CO_2$, as well as the vapor. So long as the liquid is there, the vapor pressure remains constant and the power of the gas charge stays the same for all shots. When using compressed air cylinders, each successive shot is less powerful than the preceeding one.

**PISTOL KIT**

Merchandising of gas weapons has kept pace with other selling, as is evident in the pistol kit pictured above. Gun, pellets, gas cartridges and targets go into a portable case.

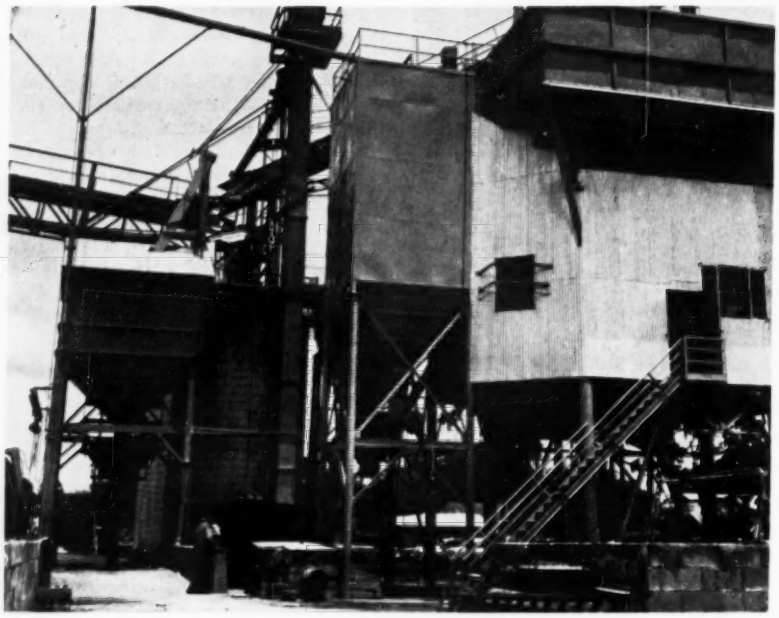
In the modern world of compressed air and gases, there are many specialized "guns" besides those that provide shooting amusement. For example, the tubes that start torpedoes on their way from today's atomic submarines are air powered. During World War II, air-powered machine guns fired BB's to train air gunners. The U. S. Army even has one type of air gun that surpasses in size the ponderous *Vesuvius* weapons. These air guns are located at the Picatinny Arsenal, Dover, N. J. One will handle projectiles to 2 inches in diameter and two will take shells of 5-inch diameter. Powered by compressed air, their barrels are 102 feet long. The guns are used to scientifically obtain test results of new artillery rounds and fuses, atomic munition assemblies, explosives, rocket motors and the like.

Use of compressed air, instead of the actual explosive, allows the cartridge to be stopped in a backstop without being damaged. The air pressure applied has been previously determined to equal the pressure of the explosion that will propel the projectile under actual field conditions. There are no loud noises, no recoil, and the method is much more economical for the taxpayer. The unique weapons use an aluminum cylinder to contain the shell during the firing, and the carriage and its shell come to a stop within the barrel, closed at both breech and muzzle ends. Of the 102 feet of barrel, only 80 feet are utilized for experiments. Air also forces the projectile back to the breech after a shot has been made.

These guns, perhaps the largest air weapons ever built, can speed shells along at accelerations of 200 to 120,000 g's. During the flight of a 90-mm round, for example, the projectile attains an acceleration of 35,000 g's—or a force of 35,000 times its weight at rest. In cases when it is not convenient to fire the projectile, the round being studied is placed near the muzzle end of the barrel. Then, compressed air is put to an unusual application that probably even Da Vinci couldn't have envisioned—air "fires" the target at the projectile.

**REPEATERS**

These gas-powered repeating rifles utilize two different mechanisms for placing a projectile into the breech before firing. The lever-action model just below has a magnetic swing device that positions BB's to be fired. The lower rifle uses its bolt action to transfer each pellet. Both rifles have spring-fed tubular magazines.



**LOADING RAMP**

Aquatite Tile Company's plant in Bradenton, Fla., has installed a number of air-operated devices in a $65,000 modernization venture. The plant converted from dry-mix to slurry-mix methods. Gates on the loading ramp hoppers (left) are equipped with air "muscles."

# Concrete Batching

H. J. Miller

COMPRESSED air has entered the ready-mix concrete picture to solve some of its most perplexing production problems. It has also helped one firm to stifle civic ire and inaugurate economies impossible to achieve through conventional production practices. The Aquatite Tile Company, Bradenton, Fla., has installed a number of air-operated devices as part of an all-around expansion and modernization program. The basic change made in the production operations at Aquatite has been the conversion to the cement slurry process.

Although concrete long has been more widely used in construction than all other materials combined, the field, from many points of view, now seems actually to be just getting into its stride. Producers are agreed that the slurry process is a major factor in making concrete the better material it is today. Cement, the binding agent, is the most expensive ingredient in the finished product. This means that it must be treated in such a manner as to develop its fullest value and best qualities. Instead of the conventional method of dry mixing, the slurry process calls for cement to be mixed with water prior to combining it with the aggregates. The function of this dispersion in water is to reduce agglomerated "clumps" of the binder to individually wetted particles. The maximum surface area of the cement is thus exposed to water for the most complete hydration of the cement. The higher ratio of hydrated to unhydrated cement imparts greater strength and stability to the concrete.

At the time that the slurry process was installed at Aquatite in a $65,000 modernization venture, a number of compressed air applications were also put into operation that have resulted in large-scale economies. Compressed air for the facility is furnished at pressures up to 125 psig by a 2-compressor plant. The air-cooled units are identical and of 2-stage construction having cylinders of 5&5&3½x4 inches. Each is driven by a 20-hp motor.

In the old, dry-batch plant, cement and aggregate were fed to the mix trucks from their respective hoppers. Gates were manhandled by means of long, cumbersome and slow-acting levers. Besides being a laborious and time-consuming

**CONTROL STATION**

In place of clumsy, slow-moving hand levers, compressed-air-actuated cylinders speed the batching operation. At the control panel, shown above, are the air valves that regulate the process.

manual operation, the practice resulted in a series of problems, especially on windy days. Dust from the cement was picked up by the wind and deposited not only on the plant property, but on neighboring homes and yards as well. Civic relations were strained. The dust penetrated the engines of the ready-mix trucks causing wear and premature overhaul. In attempting to adjudge and compensate for the shortages of mix caused by the blowing wind, coupled with the slow controls, batching personnel sometimes over- or underestimated quantities. Variations of cement quantity of 25 to 50 pounds per batch, over or under specifications, were noted.

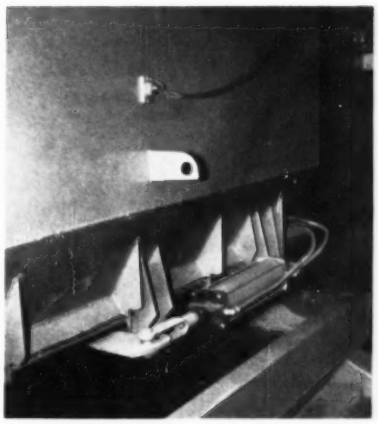
In the new slurry plant, the manual gate-handling levers were replaced by powerful air-cylinder actuation. Rapid, positive opening and closing has helped to solve the dust problem by avoiding the opening and closing "trickle stages" when the flowing materials are most subject to wind pick-up. The precise control has brought about more accurate batching and thus improvement in the finished product.

Another problem solved by the use of air-actuated gates was that of dribbles on the trucks. Spillage of cement and aggregate onto the mix trucks caused by slow hand actuation required that each truck be cleaned before leaving the plant. If this weren't done, the abrasive material coated the drum, worked its way into bearings and resulted in excess wear and down time on the expensive rolling stock. The time saved each truck driver by being able to load and leave immediately for his delivery point is important to the over-all economy of the operation. This time savings, plus that gained by the rapid-fire batching operations possible with air-operated gates enables the plant fleet to operate with at least one less truck. (Modern mixers, of the 7-yard capacity utilized by Aquatite, cost approximately $18,000 to $22,000 plus the operating charges.)

Compressed air plays an important role in materials handling as well. Not only is the cement air-borne to its various hoppers, but both it and the aggregates are "fluffed" with air to assure their easy flow from the bins.

Water for the operation is drawn from city water mains. In the quantities needed for batching plant operations, the water flows too slowly from the connecting pipes. A system of air pressurization was put into operation in which air at 80 to 90 psig is utilized to push plant water supplies to points of use. The difference is graphically illustrated in the fact that it used to take 2 minutes to fill a truck with the water for a 7-yard batch, whereas it now takes 30 seconds.

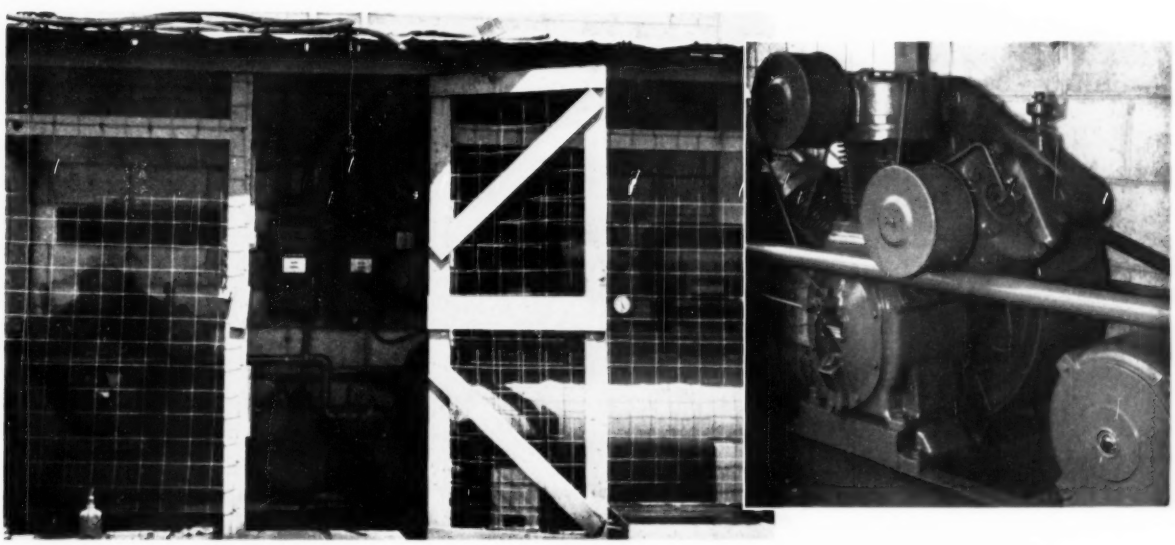
The over-all economy of the plant is much improved. Operations now progress continuously with air muscles replacing those of the operators. One man now can feed a batch to one truck and at the same time weigh up the materials for the next truck in line. When the first is ready to pull out, the load is ready to dump into the next one. Aided by air, bigger batches can now be weighed out at one time—in the old plant, a 1½-yard batch was the maximum. Now loads of 10,000 pounds, or about 2½ cubic yards, can be compounded.



**GATE CYLINDER**

Fast positive movement of bin and feed hoppers wastes no aggregates, insures accurate amounts of all ingredients in each batch. Rapid opening and closing of gates by cylinders such as the one shown prevent trickle stages during which cement and aggregates give off the most dust.

The utilization of air-actuated controls has also made it feasible to maintain the old dry plant as a stand-by. If something should go wrong with the slurry equipment, the switching of air valves can divert the air-borne cement to the dry batching section so that operations will not be interrupted. It also results in great savings in instances when a customer will need a small amount of ready mix after the day's operations have been concluded and the slurry equipment has been washed and flushed.



**COMPRESSORS**

One of two Type-30 Ingersoll-Rand 20-hp compressors installed at Aquatite Tile Company is shown at the right. This machine is used primarily for stand-by service and discharges to the same receiver as the base-load machine. The compressor enclosure is shown in the other picture. Visible through the screening are both machines, the stand-by unit at the left and the receiver-mounted unit at the right. The former is belt driven, while the latter is direct-connected. Both units are air cooled and are of 2-stage construction.

**DOUBLE DUMBBELLS**

Each of eight dumbbell-shaped piers consists of two 12-foot-diameter reinforced concrete pile caps embedding the tops of either six or eight 18-inch-diameter pipe piles and joined by an 18-foot-long, 4-foot-wide concrete strut. Pipe piling extends to bedrock as much as 80 feet below water level.

# *AERATED ANTIFREEZE*

Courtesy,
THE DRAVO REVIEW

FROZEN lakes and rivers present an imposing challenge to construction men in Canada. Winter will have its way . . . almost!

During this past winter, construction of a new highway bridge in one of Ontario's leading summer resorts proceeded in subzero temperatures with the aid of an underwater aeration process which kept the working area free of ice.

The process was developed by Dravo of Canada Limited, Toronto, Ont., in building the substructure for a new 4-lane bridge carrying Highway 11 across Vernon Lake Narrows at Huntsville, 140 miles north of Toronto.

In the aeration process, compressed air is passed through holes in a plastic pipe laid across the floor of the channel. The air forces the warmer, denser water at the bottom of the channel to the surface, thus preventing ice from forming.

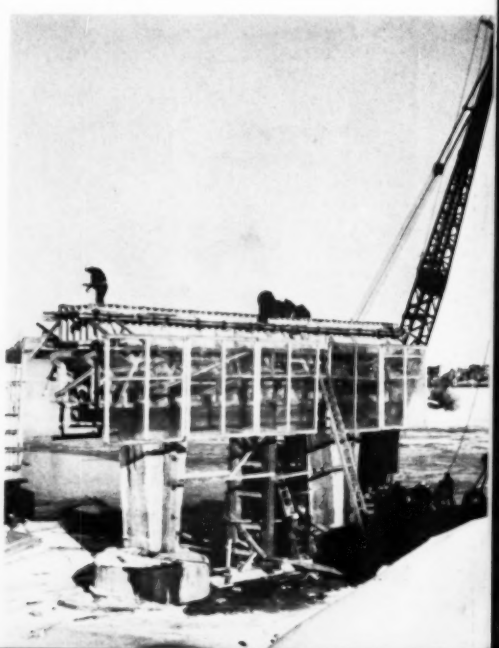
The pipe, which is 1½ inches in diameter and has 1/16-inch-diameter holes at 10-foot intervals, was laid from the deck of the derrick boat. As the pipe was paid out, concrete weights were added at 20-foot intervals. At its maximum depth, the pipe lies 25 feet below the lake's surface. Compressed air is supplied by an Ingersoll-Rand Gyro-Flo rotary diesel compressor on shore.

**FERRYING CONCRETE**

Two derrick boats, a barge and a ferry were used in the project. Concrete was supplied from a 1-cubic-yard mixing plant on shore and shifted to buckets on the ferry by an air-powered transfer buggy.

**WEATHER PROTECTION**

Another cold weather device was employed by construction crews. Wooden frames covered with polyethylene plastic protected both men and concrete from icy winds during pouring operations.



*For Automotive Air Suspension Tests—*

# *Compressors Simulate Road Conditions*

CLOSED-TYPE air suspension systems built by AC Sparkplug Division, General Motors, posed many difficult problems to the development of automatic testing equipment. Engineers at Jered Industries, Inc., Hazel Park, Mich., overcame the difficulties by utilizing two air compressors to simulate road conditions for functional testing. Each is a high-pressure unit: one recompresses a nitrous oxide-air mixture used for leak detection; and the other supplies functional test air and air to be mixed with the nitrous oxide. A Type 30, 4&1½x3½, 5-hp compressor delivers 800-psig-pressure test air at 6.5 cfm; a smaller, 3&1¼x2¾, 2-hp unit compresses a 10-percent mixture of nitrous oxide and air to 375-psig pressure for use in leak detection. Both are 2-stage, air-cooled units manufactured by Ingersoll-Rand Company.

Each air-oil separator in the air suspension system is functionally tested by valving, timing and pressure conditions automatically selected to simulate road conditions. Periodically, they are given high-pressure burst tests. The multiple-chambered separator is positioned in an explosion-proof chamber designed to protect the inspector in case of failure during the burst tests. Air cylinders advance probes into selected ports in the test piece, and automatic valving sequences the pressurization of the desired chambers. The probes engage a different combination of ports at each test stage.

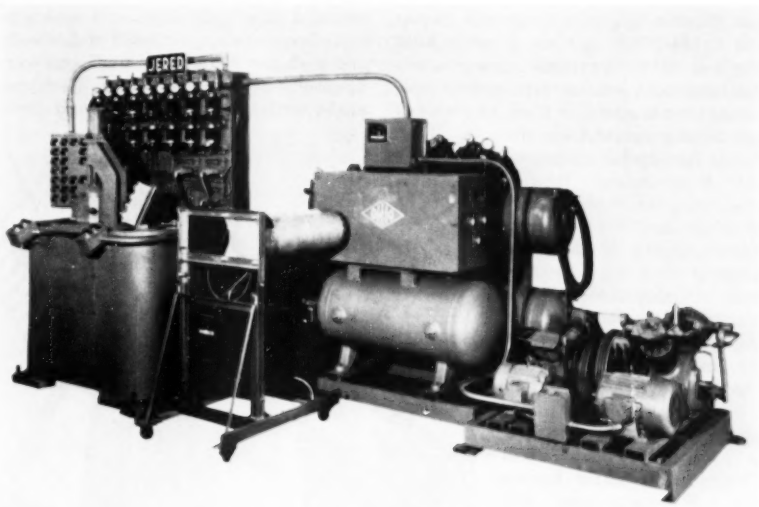
One leak detection method frequently used in vacuum systems is to fill the system with a gas, and check the joints and connections with a probe or sniffer attached to a chemical analyzer. The analyzer registers the presence of the particular gas used. This is a slow, tedious process, and its accuracy depends upon the operator's skill. Further, testing with a gas analyzer is also subject to errors induced by a lack of ventilation or excessive ventilation. If there is not enough circulation, test gas can remain in the area and falsely register leaks on good units. If there is too much air circulation, the leak can be diluted to an amount less than that capable of being detected on the sensitive equipment. Despite the apparent limitations, Jered decided that the chemical analyzer provided the best possibilities for accurate, production-rate leak detection.

Having high-pressure bottled nitrous oxide and air at 750-psig pressure from the 2-stage compressor, the engineers attempted to throttle both nitrous oxide and compressed air through a proportioner at 375- to 400-psig pressure to produce a properly diluted gas for the detection tests. Unfortunately, they could find no proportioner that could guarantee precise mixing at these pressures. By throttling both the gas and the mixing air to a pressure of 75 psig, proportioning was found to be accurate within 1 percent. The dilute gas is then recompressed by the 2-hp I-R compressor to 375 psig for the test.

Since any air-oil separator may safely have a leak rate of 4 cubic inches per hour, the test equipment had to be designed to determine not only which units leak, but which do so at a greater rate than that allowable.

The test chamber is internally contoured to the configuation of the air-oil separator, but is not air tight. An outlet in the chamber is connected to a small vacuum pump that discharges to the leak detector. In this way, a known amount of air is continually drawn through the test chamber into the leak detector.

With a 10-percent concentration of nitrous oxide inside the air-oil separator, and a known rate of air flowing around the outside of the separator, 70 parts of nitrous oxide gas per 1,000,000 parts of mixture delivered to the leak detector equals a leakage rate of 4 cubic inches per hour. At greater concentrations, the leak detector causes a red light to flash and the inspector rejects the part. Such gas analyzers as the one in this system can detect a few parts in a million.




**TWO ON A JOB**

Dual-compressors supply pressure for functional testing, positioning port probes, mixing trace gas and for leak detection. Essentially a go/no-go device, the test stand detects 70 parts of nitrous oxide per 1,000,000 parts of mixture. This corresponds to a leakage rate of 4 cubic inches per hour in the air-oil separator of an automotive air system being inspected.

**"I asked them if they had an opening for me, and I've been in a ditch ever since."**

# Something About Windmills

ALTHOUGH windmills are often thought to be Dutch in character, they are used commonly throughout the world. Their history is long, and the future of the mechanism is likely to be equally extensive, especially in view of our rapidly dwindling fossil fuel supplies. Like solar energy, wind power will always be with us.

Early records of windmills are scanty, the first detailed notations being about the 'mills in Germany, the Netherlands and the surrounding low countries during the twelfth century. Because of their intricate mechanisms, they have always interested mechanical artists, and a few of the early drawings are still to be seen. There are, further, unverified indications of their use long before 1100 A. D.

Of the records in existance, the most detailed are of tests made during the eighteenth century by John Smeaton and Charles Augustin Coulomb. Smeaton (1724-1792) was an English civil engineer who improved upon various mathematical, astronomical and navigational instruments. In 1759, he received the Copley medal from the Royal Society for his paper, *An Experimental Inquiry concerning the Native Powers of Water and Wind to turn Mills and other Machines depending on a Circular Motion.* During the course of his work, he designed and improved the nature of windmills and similar mechanical devices.

Little is known of Coulomb's work with windmills. A French physicist (1736-1806), he is better known for his experiments and fundamental laws concerning magnetism and friction. However, in 1781, Coulomb published a paper on friction as applied to windmills, and it was this contribution that greatly affected the design of all future 'mills.

Daniel Halladay is generally given credit for introducing the windmill to the United States. His first model was developed in the mid-1850's, and utilized a sectional wheel with wooden sails. American 'mill design has favored smaller sails—ones with many narrow slats set radially and quite close together. They have been placed along the coasts and in remote locations. Wherever climatic conditions similar to those on the Continent exist, windmill design has followed that of the low countries. Halladay's designs proved so successful, it was less than 3 decades before solid-wood wheel 'mills were produced. These became the forerunners of today's steel-sail models.

Windmills are of two distinct types, known as the German and the Dutch. The former is sometimes called a "post mill," for the entire building upon which the sails are mounted may be turned to orient the sails with the wind. The Dutch variety has a moving top that contains the 'mill shaft and bearings. Both have similar windsails and wheels, and each has inclined axles. These were originally placed at about a 15-degree angle, for it was felt that the wind direction offering the maximum potential power was to be at a similar angle. Thus tilted, the tips of the sails on the earlier 'mills barely missed the ground, as Don Quixote discovered when he mistook the revolving arms and sails for giants. So common were the huge, low-swinging blades of European windmills and so popular was Cervantes as an author, phrases such as "to tilt at windmills" and "to fight windmills" were quickly adapted. They are still used and have come to mean fanciful schemes or imaginary evil opponents.

Sails are constructed of either solid forms or canvas stretched across slats. They often number as many as six, and, as indicated, some American versions have many more. The sails are attached to the arms that radiate from the axle and their size varies. On a 60-foot-diameter wheel, the sail usually begins 4.5 feet from the axle and extends to the arm's extremity. In some cases the width of such a sail remains a constant 4.5 feet, but in others it increases as the outer end is approached. The panels may be plane, concave or warped, the last mentioned being the most common and efficient of the three.

Power is generally transmitted through a large, toothed wheel on the inclined axle that meets with a pinion on a vertical shaft that extends downward through the mill building.

Although these windmills depended upon the blowing wind to perform their work, they were not entirely the slaves of the wind. When the wind velocity became too great, they were not forced to spin at dangerous speeds; rather, means were found by which the total surface of the sails could be decreased. However, to accomplish it, the mill had to be stopped, thus temporarily halting the power supply. Subsequent improvements brought the windmill into the realm of the prime movers, for ways were found to govern the speed of the sails. One such method was to make the sails of multi-slat form, each slat being pivoted. If the wind velocity became too great, it forced the slats open, allowing some of the air to pass through the sails, thus checking the speed of the windmill.

With the appearance of small, economical gasoline engines, windmill power disappeared for a considerable time. In recent years, however, they have again come into popularity in rural areas for pumping water, and even more recently, they have appeared in isolated locations where more common fuels for power are prohibitively expensive to import. In the latter case, they are used to develop electrical power to be used, for examples, as aids to navigation and in communication.

Many oil companies are finding that windmills will supply adequate power to activate fog horns and warning lights on their off-shore drilling rigs, thus warning other craft of existing dangers. In the Gulf of Mexico alone, nearly 3000 such aids are maintained.

The German Federal Postal Depart-

ment, in 1953, decided to use wind power to operate a radio relay station on Mount Schoneberg. From this 2230-foot-high site, where the wind velocity averages 14 mph, an ultrahigh frequency, line-of-sight transmission station was installed as a part of a relay or rebroadcasting network. Remote locations, such as this, thus become economically usable. Standard fuels for power production do not have to be imported; wind power is there.

Designs developed along two lines: the slow-speed windwheel, as typified by the American multibladed type, to drive a dynamo; and the high-speed wheel for specific uses.

The use of high-speed wheels has increased in favor because they are more efficient; the higher speed means less gearing that is required to drive a dynamo at the proper rate; the surface of the blades can be small in area, thus reducing the gale-damage potential; and they are more easily erected. They are positioned as high as possible so as to have a minimum of wind hinderance from such natural obstructions as trees.

Windmills are still being constructed. One of the more recent in America was built by Automatic Power, Inc., of Houston, Tex. It manufactures wind-driven power packages consisting of a 6-kw generator, a battery and a stand-by diesel generator. During periods of low wind velocity, the battery carries the load. At a predetermined level of discharge, the stand-by diesel generator automatically starts. Average installations require operation of the diesel generator less than 10 percent of the time.

The power plants are mounted on 33-foot steel towers that are capable of withstanding wind velocities in excess of 100 mph. A special storm-stop feature automatically feathers the blades when the wind velocity exceeds 45 mph.

Basic engineering of the wind generator was done by Dr. Ulrich Hutter, systems director of Allgaier Company of West Germany. His high-efficiency blade design permits electrical power generation at wind velocities as low as 6 mph, while maximum continuous output of 6 kw is obtained at a wind velocity of 20 mph. Hydraulic pitch control of the 33-foot-diameter propeller-type blades assures constant generator speed at varying wind velocities. The blades turn at 86 rpm, and are connected to the 1500-rpm generator through speed increasing gears. A small steering fan serves to keep the proper orientation with respect to the wind direction.

Dr. Hutter's units are intended primarily for use in remote areas, and each is designed to operate on an automatic basis: they can be unattended for periods as long as 6 months. At present, more than 60 such package installations are in operation throughout the world. They are supplying power not only for radio relay stations, such as the one in the German mountains, and as aids to navigation, such as are found in the Gulf of Mexico, but as pumping plants for irrigation and draining and for power plants for remote farm areas, islands and small housing estates.

Other groups throughout the world are also working along such lines, notably in Spain, France, England and Denmark as well as Germany. According to Dr. Hutter, there exists within "the steady personal and written exchange of ideas and experiences . . . a spirit of friendly coöperation and collaboration familiar to the early history of aviation and of amateur radio telegraphy."

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# *This And That*

**Yellow's Here To Stay**

Nickel, which is used in making more than 3000 alloys, is now serving in yet another role. It has been found that it contributes color stability to yellow paint pigments, formerly one of the most perplexing problems in the paint industry. Of all paints, yellow was especially susceptible to the ravages of sunlight, heat, moisture and corrosive atmosphere. The two new pigments, called Sun Yellow N and Sun Yellow C, combine outstanding light-fastness with alkali- and heat-resistance. They are also impervious to acids, and are suitable especially in outdoor and masonry paints, as well as in automotive and industrial finishes. Combinations of metallic oxides and titanium dioxide were found to produce color-tinted varieties of the famous titanium dioxide pigments with locked-in chemical colors developed by Du Pont. Besides imparting the yellow color, nickel, which is present to the extent of about 3 percent, contributes to the pigment's high-durability and chemical-resistant qualities. Pigment separation, with a resultant uneven change of color, is a common problem when tints are made by mixing a white titanium dioxide pigment with a colored pigment. But with the Sun Yellows, pigment separation is impossible because each pigment particle is yellow; the yellow is locked into the paint.

* * *

**Curing Boiler Cancer**

To the long string of medical *-iatrics*—geriatrics, pediatrics and the like—engineers have added *thermiatrics*. Douglas E. Noll used the term before a meeting of the American Society of Mechanical Engineers when he said that modern boilers frequently fail because of the spontaneous growth of iron oxide (rust) in regions of high heat transfer, despite the use of treated water, which solved the problem at lower temperatures. Like doctors who have conquered old diseases such as measles and typhoid fever, but who must now face new problems, such as old age; Noll said that engineers have solved the problems of boiler design but have found new ones. Iron oxide "cancers" that form in boiler tubes now can be analyzed by microphotography; and acid cleaning, changing heat distribution or mechanical surgery (removal) may be found to be the cures.

* * *

**Useful Atomic Wastes**

Part of the radioactive waste from nuclear reactor operations has been Cesium 137. Now a process has been developed to permit its separation from the other wastes; and it is available for use in cancer therapy. The radioactive isotope does not replace Cobalt 60, long used in cancer clinics, but is a new approach to the problems of the disease. The Cesium 137 unit is being manufactured by Commercial Products Division of Atomic Energy of Canada Limited.

* * *

**Air For Oil**

By floating bearings on a thin layer of air, or other gas, instead of the customary oil-type lubricants, much cleaning and maintenance work on machinery can be eliminated. The lubrication with air can be accomplished, it is said, when the air or gas is injected around bearings at a high

pressure, or when a "normal hydrodynamic action" is utilized. The lubrication depends upon a wall of air that is built up in front of a rapidly rotating bearing. According to Science Service, many of the machines thus equipped have met American Society of Mechanical Engineers' specifications.

* * *

**Can Warms Itself**

A safe, many-purpose self-warming can container has been marketed by Etablissements Panimex, Paris, France. It is a double-shelled package containing a heat source that is activated by a simple hand-twist. It heats the contents to 90°C (194°F) in 20 minutes. No other heat source is required and, according to the inventor, there is no risk of fire. The self-warming container is said to be suitable for all out-of-door needs.

* * *

**Trans-Canada Tourism**

Winding 4480 miles, from the Atlantic to the Pacific, the Trans-Canada Highway is nearing completion. It is hoped that the route will be finished by 1960; however, at the present time, there are enough supplemental highways so that the traveler may use the "whole" route for his pleasure. When completed, there will be nearly 150 camping sites and picnic areas, none of which will be less than 15 acres in size. These locations will be paid for jointly by the Federal Government and the provinces, the Dominion paying according to the number of miles of the highway through each province. In a recently held conference, by the Minister of Northern Affairs & National Resources, it was also determined that all of the approach highways would be made to conform to a set of minimum standards.

* * *

**Summary Of Pollution Conference**

That low-hanging blanket of air and sundry foreign matter, that makes grown persons cry and besmirches buildings, and which is collectively known as smog, was the subject for a national conference in Washington, D. C., last November. From the conference emerged some 80 papers and a plethora of discussion that have now been condensed by the U. S. Public Health Service into a 42-page booklet. The publication is entitled *Highlights Of The National Conference On Air Pollution*, and contains a digest of the six discussion sessions of the gathering and a report of the resulting recommendations. The major subjects discussed are the extent of air pollution, its sources, health effects, economic and social effects, methods and procedures for control, and administrative aspects. Included are portions of statements by the Secretary of Health, Education & Welfare, Arthur S. Flemming, Surgeon General Leroy E. Burney, and Senator H. Kuckel, who, in 1955, introduced the first federal air pollution control legislation. The full text of the proceedings, described as being one of the most comprehensive references on the subject, will be published in a few weeks. Meanwhile, copies of the *Highlights* summary are available at 35 cents per copy from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Free single copies may be obtained from Air Pollution Control Program, Bureau of State Services, Public Health Service, Washington 25, D. C.

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**Pebble Joints For Dams**

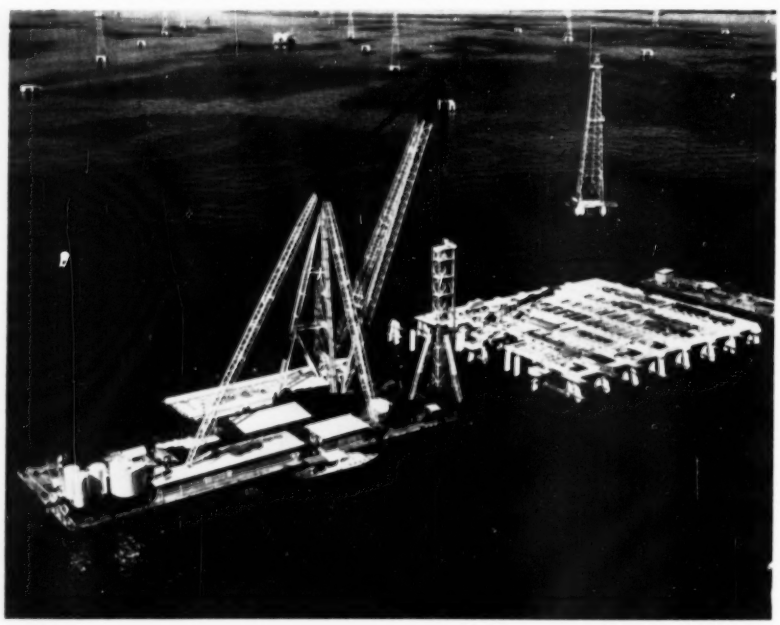
When a river dam is founded partially on rock, and partially on clay, differential settlement is a foregone conclusion. Claudio Marcello, design engineer for the Salso River Dam being built in Sicily by Impresa Umberto Girola, Rome, decided to use pebble-lubricated jointing to permit deformation and adjustment to future settlements without altering the static efficiency of the structure. The upstream half of the 183-foot-high, 770-foot-long gravity dam rests on sandstone; the rest is on clay. Most of the structure is formed of 13.12-foot (4-meter) cubes of concrete. Those on the downstream face are shaped to conform with the inclination of the face. The horizontal joints between the monoliths are staggered from one vertical row to the next, thus avoiding continuous planes of separation. The upstream face is made of a $^{15}/_{64}$-inch metal plate, formed of welded sections, and fastened directly to the blocks.

* * *

**Coustifab Deadens Jets' Roar**

Strange as it may sound, exceedingly weight-conscious jet airliner manufacturers are lining their planes' fuselages with lead. Actually, the lining, Coustifab, is a sound-deadening fabric coated with vinyl plastic. This plastic, applied to either cotton or fiber glass fabric, contains a small amount of powdered lead. This provides a flexible material of sufficient mass to absorb jet engines' loud low-frequency sounds which normal acoustic material cannot mute. Engineers at Mobile Plastics Division of the Cordo Chemical Corporation developed

## FOURTH CREOLE INJECTION STATION



**Construction has begun on Creole Petroleum Corporation's fourth gas conservation plant, called Bachaquero 1, in Venezuela's Lake Maracaibo. In the picture above, concrete piles are being driven into the lake bed through more than 75 feet of water to support a 1-acre platform. Later, compressors will be mounted on the platform to inject as much as 150 million cubic feet of natural gas daily into the oil-rich formations below. Part of the "oilfield" which Bachaquero 1 will serve can be seen in the background.**

the coated fabric to meet rigid airline specifications that called for an efficient, flexible and easy to install sound-absorbing material. Flexibility is made possible by the coating, based on Geon polyvinyl resins supplied by B. F. Goodrich Chemical Company. After the lead powder is mixed in, the coating is spread onto the fabric, forming a tough film. The addition of structural weight to a jet aircraft must, of course, be carefully calculated, and panels of the lining are tailored in several weights to meet fuselage section requirements. The manufacturer visualizes that the material may be used for an antiradiation lining for X-ray rooms or as a sound dampener for business machines.

* * *

**Lightweight, High-Pressure Gas Tank**

A high-strength, seamless aluminum container having an internal pressure capacity of 480 psig has been developed by Aluminum Company of America and Virginia Smelting Company. The can is designed to hold refrigerant gas (Du Pont's Freon-22) and is easily portable. It replaces large, heavy containers previously used and is disposable, unlike other tanks which are designed for refilling. Marketed under the name of Can-O-Gas, it holds 14 ounces of the refrigerant, and is formed by Alcoa by the 1-operation impact extrusion process, requiring no joining or welding. The container has successfully passed hydrostatic, fire and high-velocity-bullet tests and has been granted a special shipping permit by the Interstate Commerce Commission.

* * *

**Inches Are Not Inches**

What is an inch? What is a yard? The former, derived from the latter, is exactly equal to 25.4 mm, or so it will be after July 1. Directors from standards laboratories in Canada, New Zealand, the United States, the United Kingdom, South Africa and Australia met recently and assigned identical values to the inch and the pound for precise measurements in science and technology. Known as the international yard, it will equal 0.9144 meter. According to the standards now in use in the United States, as defined by the Mendenhall Order published in 1893, a yard is 0.91440183 meter long, thus an inch is 25.4000508 mm long. In the United Kingdom, an inch is 25.399956 mm. The new international inch will be approximately 2 parts per million shorter than that used in the United States, and a similar amount longer than the one now used by the United Kingdom.

The same has happened to the pound. The international pound will be equal to 0.45359237 kg. Currently the pound in the U. S. is equavilent to 0.4535924277 kg; in the U. K., 0.453592338 kg; and in Canada, 0.45359243 kg. Although the variations between the new pound and the old ones are seemingly small, they are of great importance, for masses can be measured with greater accuracy than lengths. The differences involved with the old style measurements are likewise significant. The committee could not come to an agreement between the U.S. gallon and the Imperial gallon—the disparity was too great. One imperial gallon is equal to 1.20094 U. S. gallons.

# Golden Beaver Awards

The Beaver's named eight recipients of Golden Beaver Awards at its fourth annual Awards Day Program in Los Angeles, Calif., January 15. In the *management* category, L. E. Dixon and John MacLeod were the awardees. Dixon is the head of the L. E. Dixon Company, which in recent years has built such projects as the Narrows, Chief Joseph, Rocky Reach and Allatoona dams and is now engaged in the joint venture contract on Tuscarora Power Plant, Niagara Power Project. MacLeod is founder and head of Macco Corporation, a founder of the Beaver's and past president of the Associated General Contractors. He is currently on the National Advisory Committee and the National Finance Committee of the AGC.

H. E. Carleton and O. S. McCormick are the honorees in the *supervision* category. Carleton, now 80 years of age, has been associated with West Construction Company, Morrison-Knudsen Company (as supervisor of the construction of the Union Pacific Railway's Aspen tunnel) and with the A. M. Coker Construction Company of which he is a vice president. McCormick, a vice president of Al Johnon Construction Company, has personally supervised all of that firm's larger projects. During World War II, he supervised construction of four Arctic air bases.

In the *engineering* category, Charles P. Dunn and General L. J. Sverdrup received the awards. Dunn, a vice president and director of Morrison-Knudsen Company and president and general manager of International Engineering Company, Inc., has traveled extensively, furnishing engineering supervision to a long list of world-famous engineering projects. General Sverdrup is a consulting engineer of international renown and a soldier of distinction. A civilian at the outbreak of World War II, he supervised the construction of a chain of air bases in the Pacific. He entered the U. S. Army in 1942 as a colonel. During the retaking of the Phillipines, Sverdrup, by then a major general, was acting chief engineer of the Engineer Construction Command, Southwest Pacific. He holds five United States and four foreign decorations for distinguished military service.

In the *supply* category, the Beaver's named James L. Lovell as this year's awardee. Western representative of Du Pont's Explosives Department, Contractors' Section, Lovell is one of the founders of the Beaver's and is a trustee of Pepperdine College. He is the editor and publisher of a number of religious journals.

Admiral Ben Moreell is the Beaver's awardee in the *special* category. Now chairman of the board and chief executive officer of Jones & Laughlin Steel Company, Admiral Moreell has had a distinguished civilian career as well as a military one. Organizer and wartime commander of the famed Seabees, Moreell directed a $10 billion construction program during World War II. Named a 4-star admiral in 1946, he was the first staff corps man and first non-Annapolis officer to hold that rank since the establishment of the Naval Academy. He holds many United States and foreign military decorations, a number of awards in the engineering field and many honorary degrees, the latter conferred primarily for his outstanding work with the Second Hoover Commission. He is a member of the nation's outstanding technical societies and a past president of many.

First awarded in 1956, the Golden Beaver is a symbol of "skill, responsibility and integrity" that may be presented not only to principals in the construction industry, but to members of supply firms, legislators and members of the press who have devoted their lives and careers to the service of construction. Although primarily a social fraternity, the Beaver's looks for means of bringing recognition to its industry and "to the competitive contract system as the cornerstone of the construction industry." The group believes that those who serve best should be recognized, and that by so doing, beneficial public attention will be drawn to the honor and success of the free-enterprise construction industry.

## SAVING WITH AIR POWER

# Application: Concrete Core Drilling

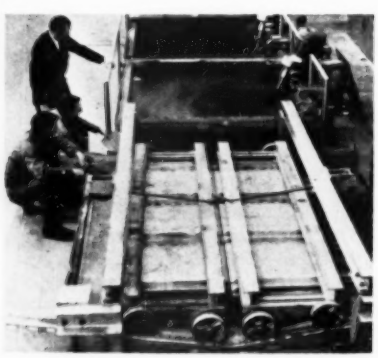
THE final task for a Michigan contractor in the building of a concrete storm sewer for the city of Detroit was to drill at least 60 test cores to ensure that the line met specifications. The sewer was 14 inches thick and had an internal diameter of 10 feet. The cores were to be at least 6 inches in diameter. Initially, the contractor asked for bids from core drilling specialists to take care of the job. When the bids were received, the lowest figure was $85 per hole—$5100 minimum—so the contractor decided to drill the cores himself. He felt he could do the job at less expense. His feelings proved correct. A contractor-supplier suggested the equipment to be used, including an Ingersoll-Rand FM3 Wagon Drill mounting an I-R Size 55SM Air Motor. The contractor used a 6¼-inch diamond core bit to cut the cylindrical portions of the sewer wall for inspection. The complete job took just 30 hours of labor time, and the contractor wrote off this expense because his men would have been on the payroll even if another contractor had done the work. The equipment cost $3171, and the total cost came to about $4000 because the contractor had initially experimented with other core drill bits before selecting the diamond type. The air equipment and its easy adaptability to his job saved the contractor approximately $1100 and did the work swiftly.

**REMOVING CORE**

A workman holds a finished core cut from the concrete sewer by a 6¼-inch diamond bit, powered by the Ingersoll-Rand 55 SM Air Motor on the I-R FM3 Wagon Drill mounting shown. By using his own men and air equipment to drill 60 of these cores, instead of subletting the job, the contractor saved some $1100.

# Application: Opening Doors Of Salt Baths

AIR is in use at the Columbus, Ohio, plant of North American Aviation Inc., helping with heat-treating of jet aircraft parts. Three salt bath furnaces, built by the A. F. Holden Company, Detroit, Mich., were installed to harden the critical components. To prevent losses of heat by radiation and convection, air-operated rolling doors were supplied. One set of these doors can be seen, in the foreground of the picture below, mounted on rollers that run on rails positioned to form a vee. Air cylinders pull lines that quickly and efficiently slide the doors open, and gravity keeps them tightly closed. The special covers do not buckle from heat expansion.



# EDITORIAL

## Wind Tunnels

XTREME SPEEDS of modern day aircraft, missiles and space craft have stimulated quite a bit of interest in controlled tests of such equipment. One of the most valuable tools of the aircraft designer is the wind tunnel. Early engineers in the field took their cue from marine engineers, long-time exponents of scale-model testing. The similarity between the two ended early, however, as the marine engineer customarily tows or propels his craft through water, whereas the aeronautical man draws or blows air past a stationary target. Some experimentation was done in early days by mounting a 'plane model on the end of a long arm and spinning it rapidly through the air, but it was found that centrifugal and centripetal effects on the models interfered with the resulting data.

EARLIEST of wind tunnels was one located at Chalais Meudon, France, constructed in 1877. Thirteen feet long and 2.5 feet in diameter, no record is available as to the power required for operation or the air velocities involved. In 1901, an engineer named Mathilath erected a tunnel at Washington, D. C., some 40 feet in length and 6 feet in diameter. Power was supplied by a 12-hp motor and wind velocities of 40 feet per second, or about 27 mph, resulted. Wind tunnel tests were instituted in Eiffel's laboratories in Paris in 1911. Aiding in the design of aircraft, as well as in the design of structures, the project was born of the Eiffel Tower. Speeds of 65 feet per second were attained (44 mph) and a 65-hp fan driver was utilized. During the First World War, the British operated a tunnel 6x4 feet in cross section at the Royal Naval Air establishment at Kingsnorth. Utilizing a gasoline-engine-driven propeller, wind velocities of 146 feet per second (100 mph) were regularly attained.

Although early wind tunnels were simply cylinders, most introduced after the turn of the century utilized the Venturi throat as a practicable means of increasing wind velocities at the model.

POST-WAR development was largely confined to making bigger and more powerful tunnels, some of which enable the testing of small aircraft full-scale or others as large as three-quarter scale. During this period, techniques of wind tunnel tests were applied to other fields of science. Eiffel's early structure-design work was carried on by a number of engineers and architects. One of the most recent applications of that nature is in the design of pneumatic buildings in order to determine inflation pressures required to resist various wind loadings. Botanists have grown plants in low-velocity tunnels in attempts to produce strains more resistant to prolonged winds, as well as to study such effects.

ADVANCES in World War II aircraft led to the design of even larger test facilities from the standpoint of power requirements. The world's largest, single, motor-driven machine is a wind-tunnel fan, for example. In a great many cases, however, throat diameters showed a tendency to remain about the same or even to decrease slightly in the effort to hold down driver sizes and costs. Increased accuracy of model making and improvements in recording instruments made it possible to achieve great accuracy of results with even very tiny models.

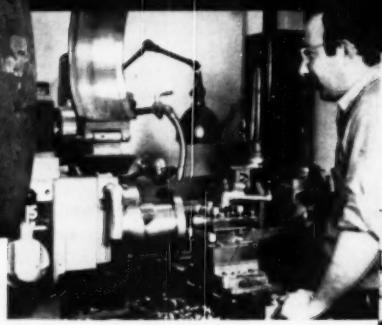
One of the outstanding problems that had to be solved by tunnel designers was that of air densities. High-flying jets encounter very thin air by sea level standards. Conventional tunnels were ill-equipped to handle problems of this nature, and thus the next step in tunnel development was undertaken—the evacuation of the tunnel prior to starting the test. This got static air out of the way of the high-speed air stream.

UTILIZATION of vacuum techniques along with growing acceptance of another step in design—the use of large stored volumes of compressed air as the immediate driving force—have made possible the capacity of present tunnels for speeds of Mach 10 (7200 mph at sea level) and even higher. Tunnels of this type rely on reciprocating or centrifugal compressors to store large quantities of high-pressure air in giant receivers. The compressors are operated for lengthy periods, but their output is released into the tunnel over a short span—sometimes less than 1 second and ranging upward to 30 or 40 seconds—thus attaining high energy values.

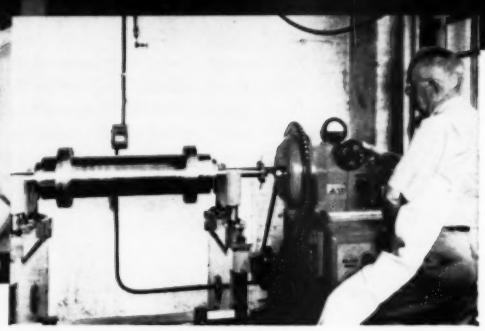
PRESENT-DAY missile research, however, is bringing back some giant-size equipment—if indeed, the big machines were ever abandoned. Re-entry problems are the most severe tests of the capacity of wind tunnels yet encountered, for the speeds involved are both literally and figuratively "out of this world." Recently the world's largest steam jet ejectors were supplied for a wind tunnel installation that will be used for missile tests as well as aircraft examinations. The four jets that make up the installation have a combined capacity of 2,000,000 cfm. Centrifugal compressors operating at pressures unheard of for that class of machine only 5 years ago are in full-scale use. It is indicative of the role played in the nation's economy and defense by the makers of air handling equipment that the advanced compressors, vacuum pumps and ejectors which are now required are ready to meet the demand.

# HIGH SPEED DRIVES CALL FOR
# JOHN WALDRON High Speed Couplings

**1** Unfinished forging for Waldron High Speed Coupling.



**2** Machining operation on Waldron High Speed Coupling at New Brunswick Plant.



**3** Dynamic Balancing of High Speed Coupling.

Today's high speed turbines and turbine-driven compressors are built like fine watches. They have to be to stand up under the terrific strains and stresses of the greater velocities. Good materials, accurate machining and balancing are essential to their service life and efficiency.

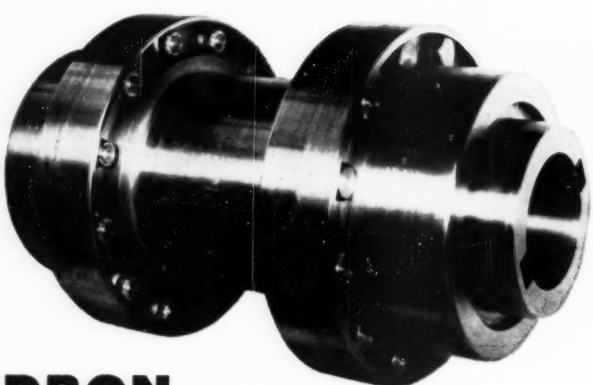
Equally important in the efficient operation of this equipment is the coupling—the power link between the turbine and the compressor. That's the reason for the extreme care in the manufacture of all Waldron High Speed Couplings.

John Waldron uses quality forgings made from SAE 4140 steel, heat treated to a Brinnell of from 285 to 315 on the outer sleeves and 225 to 255 on the hubs. This gives a good operating differential in hardness which is considered beneficial for the longer service life a high speed coupling requires.

The John Waldron method of balancing serves as a double check on the accurate machining. The nuts and bolts are all weigh balanced, the hubs are balanced separately and the complete unit is balanced on an arbor and match marked for ease in reassembly.

The result is a perfectly made and balanced coupling—and one that stresses material, workmanship and design.

**4** Assembling High Speed Coupling.



JOHN **WALDRON** CORP.

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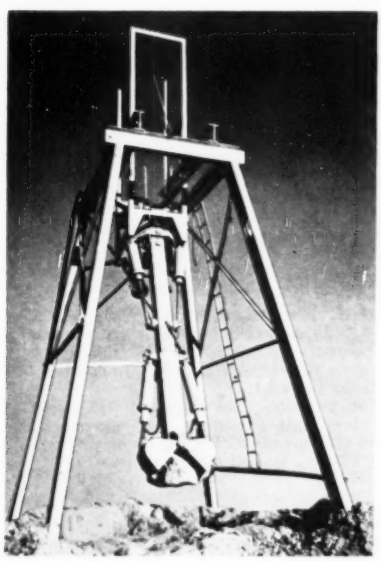
# Industrial Notes

FORGING of aluminum is the subject of a handsomely done 38 page booklet, Form 22-11184, entitled *Alcoa Forgings*. The major portion of the publication is devoted to three sections. The first, "Facilities," explains and illustrates the company's equipment that fashions forgings. Background material on types of forgings is also included. The second, "Products," is a section which contains text and many pictures illustrating the things made from this form of the lightweight metal. "Services," the third section, describes the manufacturer's design and development facilities that are basic to the production of forgings. At the back of the booklet, there are three pages of tables that list types of aluminum alloys used and their characteristics. Mechanical and physical properties are detailed, as are chemical composition limits, thermal expansion coefficients and tensile properties. *Aluminum Company Of America*, 1501 Alcoa Building, Pittsburgh 19, Pa.

DESIGNED to perform efficiently in limited space, a shaft mucker named "Betsy" is mounted on skids or rails to operate on an incline. The unit is supported so that its safety cage will not bump against shaft walls. An Ingersoll-Rand Size HU single-drum utility hoist, mounted at the bottom of the cage, raises and lowers the clam bucket inside the shaft. One operator controls mucking by manipulating valves which control air cylinders that power the machine. Two 4-way valves control the air cylinders, which open and close the ¼-yard clam bucket and power the swing and lifting units of the telescopic boom. The boom's 8-foot extension permits the operator to crowd the bucket into muck to scoop up a full load, and then quickly discharge the muck into the skip. Telescopic air tubing is mounted along the lower side of the square boom to supply air to the clam cylinders. The bucket is held in a fixed horizontal position by the square telescopic boom, allowing easy operator control.



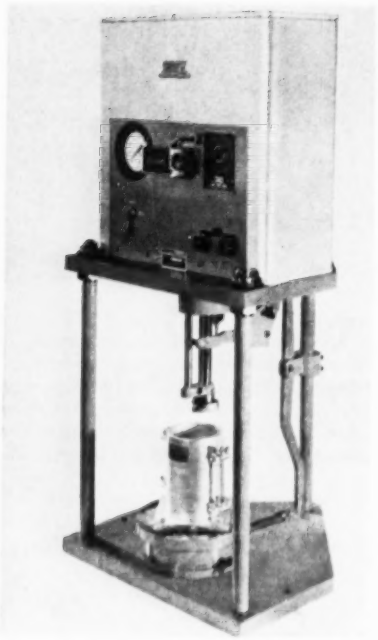
A smaller "Betsy" is also built. It is designed with a circular boom for use in circular shafts with 6- to 10-foot diameters and in compartment shafts from 4x7 to 14x7 feet in size. Its boom can be moved 12 feet forward, 6 feet back and 12 feet to either side of vertical. Boom length is 13 feet 3 inches from the center of the gimbal to the bottom of the bucket; boom extension is 8 feet, and its over-all length is 24 feet 9 inches. *Shaft & Development Machines, Inc.*, Salt Lake City, Utah.

PIPE, fittings, flanges and connections are the subject of a condensed catalog (Bulletin No. 59). The publication includes a full-page table of specifications for Naylor Lockseam Spiralweld pipe in sizes from 4 to 30 inches in diameter. Two pages of the 8-page, color publication depict connections and explain their applications. Various sizes of fittings and flanges are presented in tables, and another page gives ordering information. Installation photographs show uses for the pipe in such operations as mining and quarrying, construction, industrial, petroleum and gas gathering, dredging, paper mill and materials handling. *Naylor Pipe Company*, 1230 E. Ninety-second Street, Chicago 19, Ill.

INDUSTRIAL cellular rubber and plastics, their properties and applications, are illustrated and described in an 8-page pamphlet. The booklet explains sponge rubber, neoprene, silicone sponge, Cell-Tite (an expanded closed-cell rubber similar in appearance to sponge) and cellular vinyl. The materials are available in sheet stock, die-cut shapes, pad stock, strips, tubing and cord and molded forms for applications in sealing, vibration damping, shock absorption, insulation and flotations. *B. F. Goodrich Company*, 413 Derby Place, Shelton, Conn.

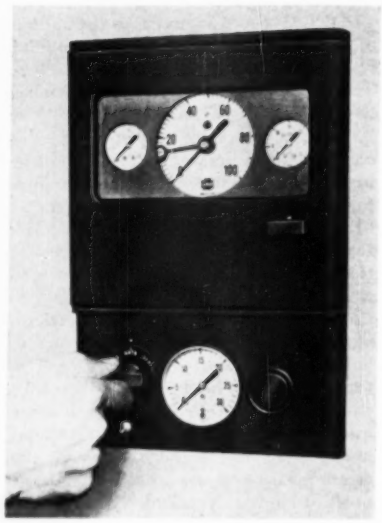
AUTOMATIC filling lubricators, in ¼- to 1-inch pipeline sizes, maintain a constant maximum-minimum oil level in the lubricators, either when used alone or in combination with airline filters and regulators. The lubricant is supplied directly from 55-gallon drums, at a central pumping station, to any number of lubricators in operation, eliminating the usual hand-filling or manual-servicing problems of stopping production because of empty lubricators and "oil-starved" air tools or other pneumatic equipment. According to the manufacturer, systems already equipped with hand-fill units can be easily converted to the new system. Further details are available in Bulletin ALS-602. *Arrow Tools, Inc.*, 1903 S. Kostner Avenue, Chicago 23, Ill.

TRUE kneading action is said to be created by an electrohydraulic compactor that affords preparation of test specimens in materials testing and research laboratories. The Model CN-425A Kneading Compactor can be used to prepare samples of bituminous mixes, asphaltic concrete, soils and similar materials. The results of the instrument's action are said to closely simulate the compaction of the material under actual field conditions. According to the manufacturer, three new elements of flexibility have been introduced in the device: adjustable compaction-foot pressures; adjustable time of dwell on the specimen; and a variable rate of com-



paction. Samples may be prepared in either 4- or 6-inch molds. A separate compacting foot is provided with each, and a heated foot assembly is available as an accessory. Other features include an automatically indexing mold table, a predetermined cutoff counter, a pressure dwell timer that can be set to a variety of dwell periods, adjustable air pressure regulators, and either automatic or manual operation. The compactor is small and can be floor or table mounted. In testing bitumens, the unit can be used in conjunction with the American Society of Testing Materials' Specification D-1561-58T, *Preparation Of Bituminous Mixtures By Means Of The California Kneading.* *Soiltest, Inc.*, 4711 W. North Avenue, Chicago 39, Ill.

FIVE wear-resistant alloys in the form of investment-castings are explained in a booklet which presents chemical, physical and mechanical properties of one iron-base and four cobalt-base alloys. Included are data and recommendations on joining, machining, grinding and heat-treating. It is said investment-casting offers designers these alloys in forms and shapes sometimes impossible to make by other methods. The alloys themselves reportedly possess excellent properties to resist most conditions of abrasion, wear, heat, corrosion and erosion. Four of them are Haynes Stellite cobalt alloys No. 3, No. 6, No. 12 and Star-J Metal. The other is Haynes iron alloy No. 93. *Haynes Stellite Company*, division of Union Carbide Corporation, Kokomo, Ind.



FOUR positions can be set on a control by-pass which is offered for use with a line of indicating pneumatic controllers. The positions are "service," "test," "automatic" and "manual." The prime function of the unit reportedly is to give the plant operator a ready means of cutting off controller air to a valve, and of positioning the valve manually. Such manual control may be needed tempor-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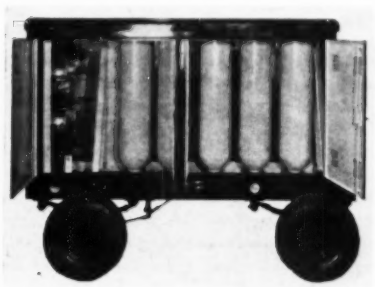
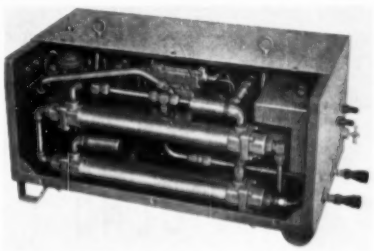
arily for one of these reasons: for starting when temperature and pressure must be raised carefully to a control point; for manual rebalancing of a process; and for adjusting, servicing or removing the unit for repair. The by-pass permits "bumpless" transfer from manual to automatic control, meaning that the operator can match air pressures from controller and manual regulator so that no difference exists to "upset" the process. Having a width of 8½ inches and a height of 11½ inches, the device mounts directly below the controller to form an integral unit. The assembly can be yoke-mounted on a diaphragm motor valve, where it provides the dual function of controller and manual operator for the valve. *U. S. Gauge*, division of American Machine & Metals, Inc., Sellersville, Pa.

MISSILE systems can be pressurized from ten storage bottles containing gases such as air, nitrogen, helium, etc., at pressures of 6000 psig. They are mounted on a military-type pneumatic-tire trailer. The bottles have the designation ICC-3AA. Two separate manifolded systems are provided, each with a high-pressure discharge hose and a quick-disconnect fitting. A control panel includes pressure gauges, selector valves and shutoff valves. Provision is also made for mounting the manufacturer's dehydrators and regulators in case lower pressure is desired. The trailer housing the bottles has a tow bar and is built for all weather use. The entire unit is called the Model KC-1093 High Pressure Gas Storage Trailer. *Kahn & Company, Inc.*, 541 Windsor Street, Hartford 1, Conn.



TO MAKE easier the task of selecting and ordering coated abrasives, a brief, practical information kit has been assembled. In it are a Buyer's Guide, Form A 1506, with convenient reference tables and forms for listing abrasive requirements; a Selector Chart for Metalworking Operations, Form A 1507; a Selector Chart for Woodworking Operations, Form A 1508; a compact brochure, Basics in Coated Abrasives for the Metalworking Trades, Form A 1509; and another brochure, Basics in Coated Abrasives for the Woodworking Trades, Form 1510. The kit is said to be factual and classified for quick easy reference, and either the entire kit or any of its parts are available on request. *The Carborundum Company*, Niagara Falls, N. Y., and Toronto, Ont.

PACK-HORSE is a high-capacity, portable hydraulic power unit that operates by connection to a plant compressed air line. The variable volume characteristics of the unit reportedly maintain desired pressure without operating during periods of no demand. The unit, it is said, gives instantaneous full pressure when needed. It is well suited for use as a stand-by power source, and has safety and control features. An integral heat exchanger insures cool operation. Over-all dimensions are 31x16x15 inches. Having a capacity of 3.5 gpm, it supplies pressures to 3000 psig and a special model will generate 6000 psig. *M. B. Sturgis, Inc.*, 601 S. Taylor Avenue, St. Louis 10, Mo.



AIR VISES built for automatic self-centering operations within tolerances of 0.001 inch, with holding power to 4000 pounds at 100-psig pressure, are detailed in Form 60. The line provides a reference for operations where fast production and reduced tooling cost are required for centering, hollow-milling, tube facing, tube spinning, tube expanding, drilling, counterboring, chamfering, deburring, countersinking, end milling, tapping, reaming, boring and many other production tasks. *Heinrich Tools, Inc.*, Racine, Wis.

MOISTURE is removed directly from atmospheric air by means of a liquid adsorbent sprayed into the air stream in a series of "controlled humidity method" dehumidifying units. The temperature of the spray determines the dry bulb temperature of the air leaving the conditioning unit; the concentration controls the air's dew point temperature, thus fixing its relative humidity. Because of this, automatic control of temperature and relative humity of the conditioned air is possible by thermostats,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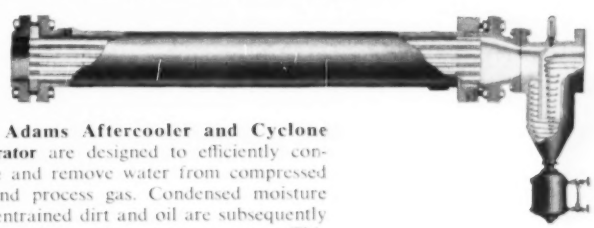

**The Adams Aftercooler and Cyclone Separator** are designed to efficiently condense and remove water from compressed air and process gas. Condensed moisture and entrained dirt and oil are subsequently removed in a cyclone type separator. This unit is scientifically designed for maximum removal efficiency over a wide range of flow rates.

**For normal use,** units are available to cool gases to within 10° F of the temperature of the cooling water. Specially designed units are available to permit a 2° F approach to cooling water temperature, for application where low moisture content is critical.

**Adams Aftercoolers and Separators** are available from stock to handle 20 - 40,000 cfm with 10° cooling and 25 - 19,200 cfm where it is necessary to cool within 2°F of the cooling water. Special units can be supplied to suit an unlimited range of requirements. In all cases the maximum pressure loss at rated capacities is ½ psi.

**This wide range of sizes** enables the economical utilization of Adams Aftercoolers and Separators in virtually all industrial application. For further information on how R. P. Adams' units will solve your compressed air problems and save you money, write today for Bulletin 711.

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no moisture-sensitive equipment being required. The concentration of the adsorbent is obtained by continuously cycling the diluted adsorbent through a unit that removes water from the system at the same rate it is taken in by the concentrator. The units are said to be indispensable when the most precise conditions or complete reliability are required. *Niagara Blower Company*, 405 Lexington Avenue, New York 17, N. Y.

PORTABLE compressors and pumps, mine tractors, personnel carriers and the like are propelled by low-voltage, variable-speed, direct-current motors. A range of ratings from ¼ hp at 12 v through 15 hp at 96 v is offered for continuous or intermittent duty for driving movable equipment in which compactness and absence of noise and fumes are

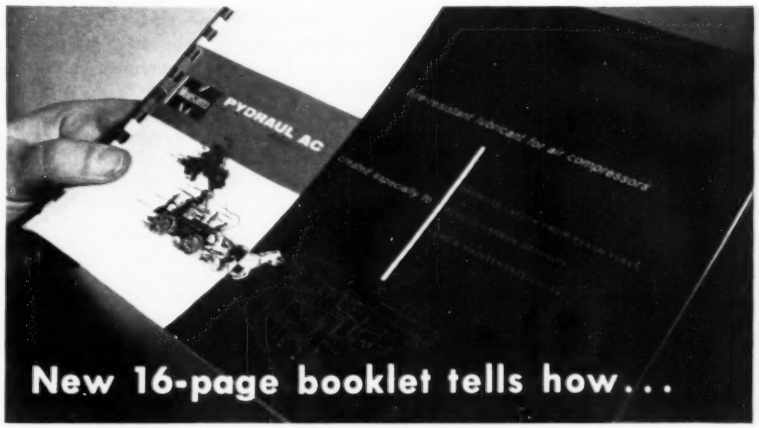
required. Pictured is a mine personnel utility car, called "Inspector's Friend," which is powered by one of the motors. The motors are available in either protected or totally enclosed designs, as well as Underwriters' Laboratories and Bureau of Mines approved explosion-proof enclosures. A wide variety of mountings is available, such as a standard foot-mounted type for vertical or horizontal mounting, or a flange-mounted type for either horizontal or vertical installations. Increased brush life, resulting in less maintenance, is said to be provided by the use of heavy-duty industrial brush rigging. Brushes have a close-tolerance fit in the brush holder, and high-tension brush springs reportedly insure even wear. Standard gear reducers are available, and oversized bearings on the drive end enable the

motors to operate with high thrust and heavy overhung loads. The motors are constructed to NEMA industrial specifications and feature class B insulation. Fractional sizes have Class "A" insulation as standard. Steel frame construction with cast iron end brackets is used to withstand moisture, shock, weathering and corrosion. *Reliance Electric & Engineering Company*, 24701 Euclid Avenue, Cleveland 17, Ohio.

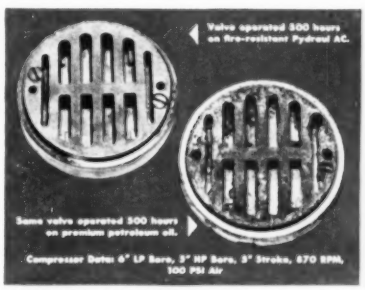
PURE high-pressure aviation breathing oxygen can be stored in an especially lightweight metal cylinder made of cold-drawn, seamless steel. The cylinders reportedly weigh approximately a quarter less than present aviation cylinders. A complete assembly consists of the cylinder, a wheel-operated or self-opening valve and oxygen pressured to 1850 psig at 70°F. A safety device on the valve relieves excessively high pressure that could result from abnormally high temperatures. A typical assembly has a cylinder volume of 520 cubic inches, charged weight of 17.8 pounds, length of 22 59/64 inches and diameter of 6 7/8 inches. *Walter Kidde & Company, Inc.*, Aviation Division, Belleville 9, N. J.

MAJOR products available from John Waldron Corporation are detailed in a 4-page high-spot bulletin. These include the Waldron standard gear coupling, Francke flexible, the 162 "M" nylon gear coupling that needs no lubrication, the Waldron Junior and the Anchor Waldron Cut-Out coupling. *John Waldron Corporation*, New Brunswick N. J.

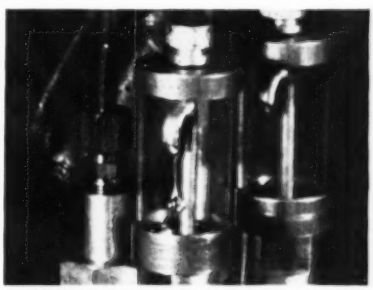
ENGINEERING and maintenance personnel may find useful, in the sizing, specifying, selection and buying of steam traps and other fluid specialties, a 40-page manual recently published by Anderson. Besides the usual catalog features, this booklet includes 23 pages of technical information that has been carefully edited for the field. It includes a selection guide, an explanation of the four basic types of traps and how each performs its function, the four steps to follow in sizing a steam trap, a

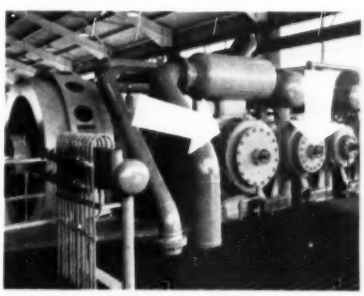

PYDRAUL AIR COMPRESSOR LUBRICANT GIVES 3 "MOST WANTED" BENEFITS AT LOWEST COST: LOW UPKEEP, PEAK LUBRICATION, FIRESAFETY


Valve operated 500 hours on fire-resistant Pydraul AC.
Same valve operated 500 hours on premium petroleum oil.
Compressor Data: 6" LP Bore, 3" HP Bore, 5" Stroke, 870 RPM, 100 PSI Air

**PYDRAUL AC RUNS CLEAN**—can substantially cut compressor upkeep costs because it reduces build-up of carbon and other deposits—extends time between overhauls. Side-by-side photos (above) of an exhaust valve—used in the same industrial air compressor with only the lubricant changed—show how Pydraul keeps systems freer from harmful and dangerous deposits than a premium oil. Lower maintenance costs alone usually justify use of Pydraul.



**PYDRAUL AC LUBRICATES** like premium-grade oil—good anti-wear and noncorrosive features give equipment long life. And Pydraul is the one lubricant for virtually every compressor you own—has demonstrated excellent lubricating efficiency in hundreds of compressors of all sizes produced by all major manufacturers—gives trouble-free compressor operation for many years. Now, Pydraul is effectively lubricating compressors operating at over 4500 psi.—many operating continually with exhaust air temperatures of 340 F.



**FIRESAFE PYDRAUL AC GIVES** protection 2 ways in this danger zone—guards these three 4,000-hp. compressors. Petroleum oil residues deposit inside cylinders, valves, piping—glow hot and flake off—can unpredictably ignite flammable vapors from hot petroleum-based lubricants, causing fire...explosion! Monsanto's synthetic lubricant, Pydraul AC, essentially eliminates this basic cause of most compressor fires and explosions: It lessens carbon deposits and oxidation residues, and it is *fire-resistant*.

PHOTO COURTESY GRACE CHEMICAL CO. PYDRAUL—MONSANTO T. M. DIV. OF W. R. GRACE & CO. REG. U. S. PAT. OFF.

New, illustrated booklet gives more details, including how to make the easy conversion to Pydraul AC. Write, today. No salesman will call unless you so request.

Monsanto

FOR CONVENIENCE, USE QUICK REPLY COUPON

Monsanto Chemical Company
Organic Chemicals Division
Dept. CA-4, St. Louis 66, Mo.

Please send me the new 16-page booklet on fire-resistant Pydraul AC lubricant for air compressors.

Name_____

Company_____

Address_____

City_____

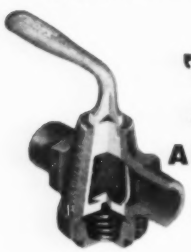
**"AIR KING"**

*Quick-Acting*

**HOSE COUPLINGS**

*For All Hose Connections*

These plain rugged couplings are your surest safeguard against loss of air at the hose connections. Universal locking heads, on sizes up to 1", snap together to form a secure lock that is leakproof under pressure; in fact, pressure must be released before coupling can be disconnected. Ideal for rough outdoor work as well as indoor shop and plant service. Malleable iron, cadmium plated, and bronze. Hose Ends, Male and Female I.P.T. Ends. Size range, ¼" to 1". Also available in 4-lug type, not universal, in 1¼" to 2" sizes.



**"BOSS"**

*Self-Honing*

**AIR VALVES**

*For the Entire System*

The most efficient and economical valves for all valve stations on the system—automatically, permanently leakproof—no packing to wear out and replace—straight-line, full-flow opening through body and plug. Self-adjusting bronze plug automatically hones itself against harder steel or malleable iron valve body, maintaining a perfect leakproof seat. Proper spring tension assures constant sealing adjustment. Strong, durable construction, with handle attached to plug within the valve body. Male or female thread both ends, in sizes ¾" to 1½".

*Stocked by Manufacturers and Distributors of Industrial Rubber Products*

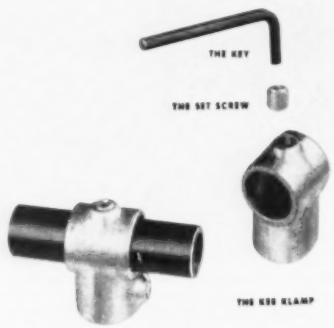
**DIXON**
*Valve & Coupling Co.*

GENERAL OFFICES & FACTORY—PHILADELPHIA 22, PA.
BRANCHES—CHICAGO · BIRMINGHAM · LOS ANGELES · HOUSTON
DIXON VALVE & COUPLING CO., LTD., TORONTO Associate Companies:
Bush Iron Company, Inc., Quarryville, Pa. · Processed Drawn Steel Company, Camden, N.J.


table of factors and detailed instructions on how to select traps for more than 45 major classes of equipment in practically every industry using steam. Copies may be obtained without charge by all qualified trap specifiers, users, contractors and engineers. Cost, $2.50. *The V. D. Anderson Company*, 1935 W. Ninty-sixth Street, Cleveland 2, Ohio.

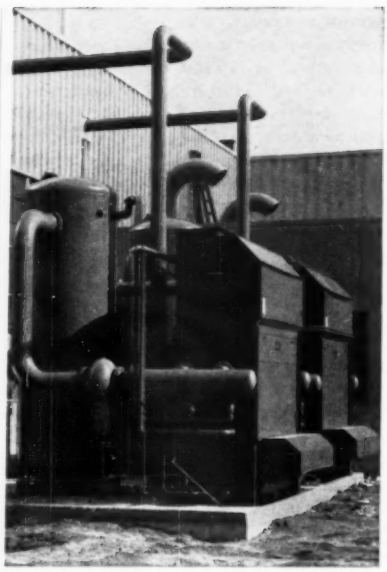
AIR couplers called Flex-O-Matic are said to feature split-second coupling action. According to Catalog No. 65, they are 30-percent lighter in weight and provide a fast, efficient means of connecting an air hose to lubricating equipment or any other air-operated devices. In addition, an extra-large air passage assures 35-percent more air flow than earlier models. *Lincoln Engineering Company*, 5703-32 Natural Bridge Avenue, St. Louis 20, Mo.

KEE KLAMPS are malleable iron fittings designed for use with plain-end iron or steel pipe used in building storage




racks, frames for signs and exhibits, railings and the like. The units are made in 56 styles for pipes from ⅜ to 2 inches in diameter and are galvanized

"Try to think of your job as one that there'll never be a machine to replace you."

*This Niagara Aero After Cooler also cools compressor jacket and intercooler water.*

**COMPRESSED AIR**
**• Lower in Cost**
**• Drier and Cooler**

THE NIAGARA *AERO* AFTER COOLER offers a completely self-contained method replacing both shell-and-tube cooler and cooling tower. It is independent of a large supply of cooling water and consistently reduces compressed air temperatures to below ambient.

Drier air gives you better operation and lower costs in using all air-operated automatic instruments, tools and machines, paint spraying, sand blasting and moisture-free air cleaning.

Direct saving in the cost of cooling water saves the price of the Niagara *Aero* After Cooler in less than two years.

Niagara *Aero* After Cooler assures all these benefits because it cools compressed air or gas below the temperature of surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air through a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter, proven in service on the largest plant utility systems.

*Write for Bulletin No. 130*

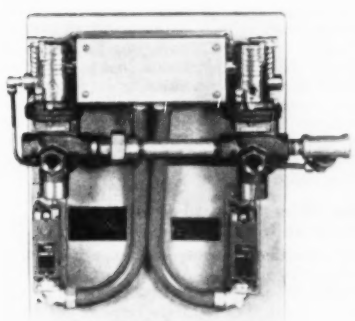
**NIAGARA BLOWER COMPANY**

Dept. CA-3, 405 Lexington Ave.
NEW YORK 17, N. Y.
*District Engineers in Principal Cities of U. S. and Canada*

for all weather use. An ordinary Allen wrench, used to tighten a set screw, is the only tool needed to assemble structures with the clamps. The wrench, and the set screws said to be capable of supporting 4000-pound loads, are supplied with the clamps. Structures built with the devices are rigid, according to the manufacturer, and can be designed for almost any load and space condition. *Kee Klamps North America Limited*, 1079 William Street, Buffalo 6, N. Y.

CHIEF characteristics of a line of ductile irons are their high strength and toughness, according to a 28-page booklet entitled *Engineering Properties of Ni-Resist Ductile Irons*. This second edition of the publication gives a detailed description of these cast metals. It contains tables and graphs explaining mechanical and physical properties, erosion and corrosion resistance, and reported high temperature strength. One section points out proved industrial applications of the Ni-Resist irons. *The International Nickel Company*, 67 Wall Street, New York 5, N. Y.

A CONTROL system that features dual interlocked, but independent, pneumatic-electrical-mechanical circuits is fail-safe and antirepeat, making the possibility of an accidental repeat operation on single-cycling machines virtually impossible. Known as the Andrus-Coon press control, it is designed to protect personnel against injury on manually operated machines, or to prevent tooling damage on automated equipment. It is suitable for use on presses, brakes, shears, indexing units and similar applications utilizing an air-operated friction clutch and spring-set brake. The system uses two separate electrical, pneumatic and mechanical control circuits, operating in tandem. According to the manufacturer, these are completely interlocked so that failure of any one, or more, control component automatically stops the machine, at once, or at the end of its cycle. It also prevents




GOOD RULE TO FOLLOW
WHEN BUYING
ANY SPECIALIZED MACHINE:
CHOOSE A MAKE WHOSE BUILDER THINKS ENOUGH OF HIS OWN GOOD NAME TO EQUIP HIS PRODUCT WITH
CONTINENTAL RED SEAL POWER

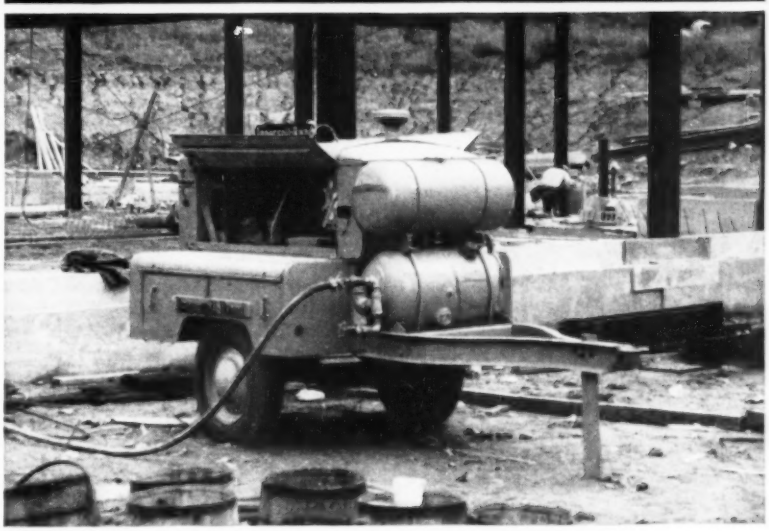


Photo Courtesy Ingersoll-Rand.

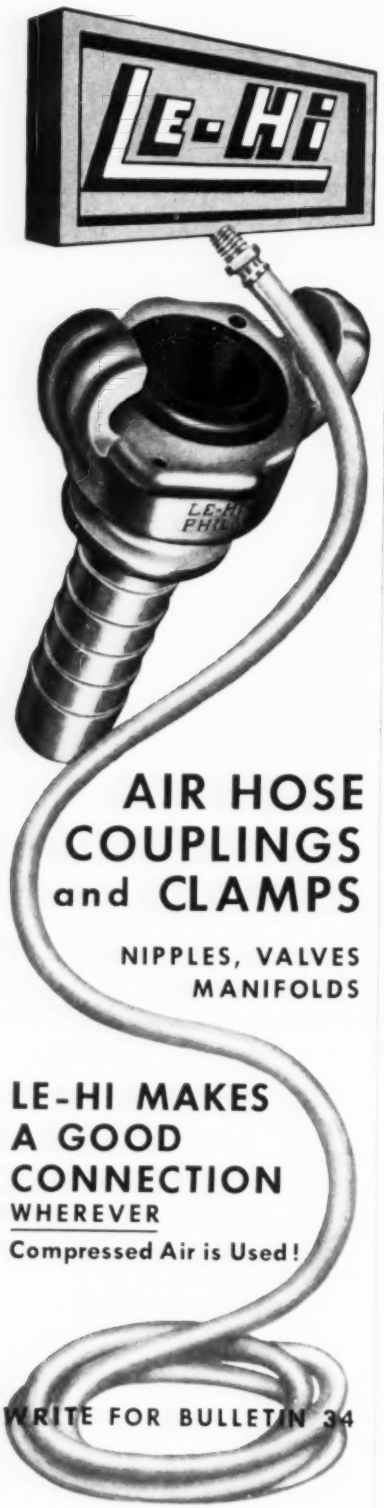
All through the construction industry, you find Continental Red Seal engines building prestige for specific makes of equipment. Within the range of industrial engines alone—15 to 260 horsepower—it would be hard to name a type of engine-driven product—compressor, mixer, pump, earth mover—of which one or more of the leading makes do not rely today on Continental power. Every Continental Red Seal is not only built for the job, but backed by parts and service facilities from coast to coast.

ANY EQUIPMENT IS BETTER EQUIPMENT WITH DEPENDABLE RED SEAL POWER

6 EAST 45TH ST., NEW YORK 17, NEW YORK • 3817 S. SANTA FE AVE., LOS ANGELES 58, CALIF.
6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 1252 OAKLEIGH DR., EAST POINT (ATLANTA) GA.
ST. THOMAS, ONTARIO

Continental Motors Corporation

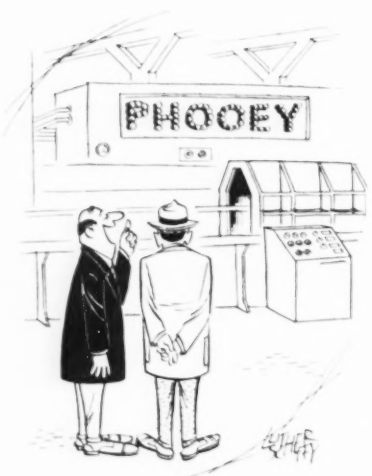
MUSKEGON • MICHIGAN




the start of the next cycle until the fault is corrected. Two poppet-type air valves, two antirepeat relays, two valve relays and two sets of limit switches, each set separately actuated, are monitored at the end of each cycle. Air valve operation is sensed by external limit switches actuated by valve stem extensions. If any control unit fails to complete its normal cycle, the monitoring circuits prevent the start of the next cycle. Built to JIC standards, the system consists of a prewired valve package and a prewired control panel assembly, plus limit and run push button switches. *Textrol, Inc.*, 4051 Prospect Avenue, Cleveland 15, Ohio.

## Books . . .

*Arc Welding In Machinery Design And Manufacture* (Published by The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio) answers common problems in machine design and manufacture. It is divided into two parts. The first is made up of four sections: "Why Weld," "Guides To Design Appraisal," "Guides To Design" and "Guides To Fabricating." A series of case histories, describing the methods by which industrial problems in design and manufacturing have been solved using welded construction, makes up the second part. This part is divided into five parts: "Rotating Parts," "Heavy Bases And Frames," "Light Bases And Frames," "High Strength Miscellaneous Members" and "Lightly Loaded Miscellaneous Members." There are two indexes to the volume—one lists the histories according to the industry or type of machine involved; the other, design considerations with the most applicable histories listed beneath it. 209 pages. Cost, $2, in U.S.A.; $2.50 elsewhere.




**"And at this station that bank of tubes is activated if there is any flaw in the material."**

ADAMS FACT FILE #2

## PLANT AIR

**Moisture Chief Cause of Trouble . . .**

Every company today is looking for ways to offset the increased costs of labor, material, equipment and services. At a gasoline station you expect "Free Air", but in industry it is a major expense. Perhaps in your own plant, for an investment in a few minor compressed air system alterations, significant savings are possible.

Water, sludge, rust, oil and dirt in compressed air systems are prime causes of maintenance and production down-time. Water vapor condensing in air lines tends to corrode the piping. Also, water present in the piping may freeze during winter, causing serious reduction of compressed air supply. Such restrictions are often difficult to locate and thaw. This same line moisture may emulsify lube oil destroying its lubricating value and the resultant mixture has high fouling characteristics. Frequently, ice will form within the tool itself since expanding air cools the moisture . . . tool efficiency will be seriously affected.

**Some of the Other Problems Created By Wet Compressed Air . . .**

Wet compressed air is not only a construction and production tool problem. Faulty paint jobs, contaminated chemical and food products can often be traced to moisture laden compressed air. Waterhammer, unequal pipeline thermal expansion and line leaks also result from collected moisture. In addition, air lost through traps, and in blow-down of compressed air lines provide no useful work . . . represent a sizeable power loss.

**You Can Lick Compressed Air Moisture Problem . . .**

All of these hidden costs can be virtually eliminated by the installation of an Adams Aftercooler and Cyclone Separator between the compressor and receiver tank. By cooling discharge air to within 10° F. of cooling water temperature — guaranteed with Adams standard Aftercoolers — the moisture can be removed at the separator. Pressure loss is less than one-half pound on these units including the separator. In severe cases, moisture removal of over 90 per cent can be obtained by cooling the air with Adams 2° Aftercooler to within 2° F. of water temperature.

**Air Filter for Final Protection at Point of Use . . .**

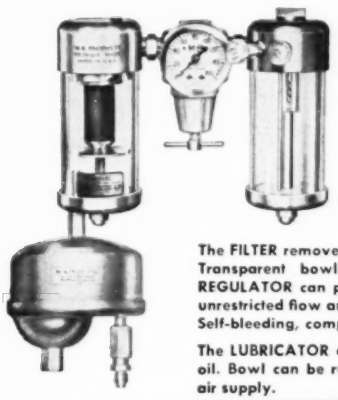
As an added safeguard for expensive tools and equipment, an Adams Poro-Stone Air Filter should be installed just before the air is used. These filters remove all solid material picked up by the air stream. With an Adams Aftercooler, Cyclone Separator and Air Filters clean, dry, trouble-free air is supplied to your production tools. You get continuous service with minimum maintenance.

For further information on how the complete line of Adams air equipment can solve your compressed air problems, write today for your free copy of Bulletin No. 712 on Aftercoolers and Bulletin No. 117 on Poro-Stone Air Filters from the R. P. Adams Company, Inc., 209 East Park Drive, Buffalo 17, New York.

GREATER PROTECTION to your AIR LINE!

M·B

**WHIRL-A-WAY FILTER, REGULATOR AND LUBRICATOR ASSEMBLY AND AUTOMATIC AIR TRAP** (MODEL W-4)



SUCCESSFULLY USED FOR PROTECTION OF AIR VALVES CYLINDERS CONTROLS PNEUMATIC TOOLS, ETC.

The FILTER removes solids .00039 and larger. Transparent bowl provides visibility. The REGULATOR can pass large volume with an unrestricted flow and minimum pressure drop. Self-bleeding, compact.

The LUBRICATOR delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

The Air Trap is automatic and eliminates manual draining.

M·B PRODUCTS
46 VICTOR AVE., Div. 14
DETROIT 3, MICHIGAN

**ELIMINATE CARBON BUILD-UP**

*in valves and rings in your air compressors*

| | |
|---|---|
| ALSO | Prevent overheating, thus reducing fire hazard. Increase compressor efficiency. Eliminate or shorten down-time. Cut labor and maintenance 50%-90%. |
| HOW | Using HYDRODYNE-AC, fed into air intake by drip feed lubricator. |
| HOW USED | HYDRODYNE-AC used by auto, chemical and other manufacturers, and public utilities. |
| GUARANTEED | HYDRODYNE-AC is a unique combination of components designed especially for your needs. If it does not perform as claimed, full refund made. |
| COST | *Unbelievable economy!* 2c to 4c for 8 hours for each 1,000 CFM. |

*Order Now:*

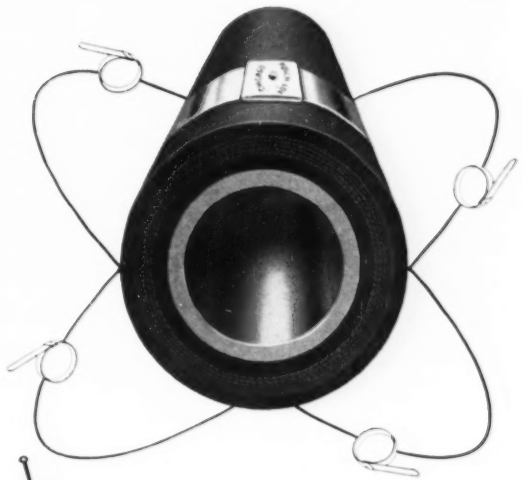
***HYDRODYNE-AC PRICES***

$9.95 per gal. in one gal. cans.
9.00 per gal. in five gal. cans.
8.00 per gal. in 55 gal. drums.
F. O. B. Clark, New Jersey

*More information available upon request.*

AQUADYNE CORPORATION
10 TERMINAL AVENUE • CLARK, NEW JERSEY

**IN ORBIT for a LIFETIME!**



**PUNCH-LOK Hose Clamps**

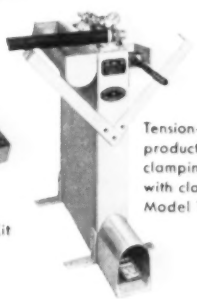
MR. LOK SAYS:
When a Punch-Lok clamp goes into orbit around a hose connection it's there to stay.

DOC PUNCH SAYS:
Tell the hose user it's a life-saver prescription for outer-space too.

**NO SNAG! NO LEAKS!**

***NEW! from PUNCH-LOK***

New K-45 Clamp-Master Kit now in all-steel carrying case finished in red baked-on enamel.



Tension-Air production hose clamping machine with clamp remover Model TA-1.

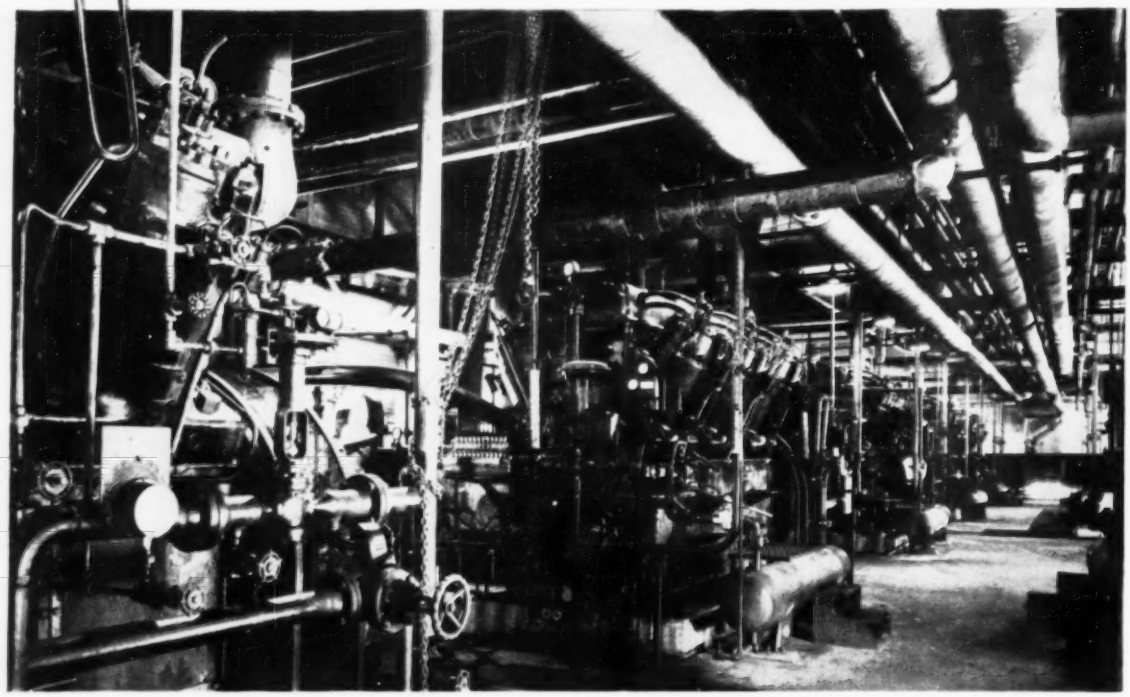
*See your nearby Punch-Lok Distributor*

8382

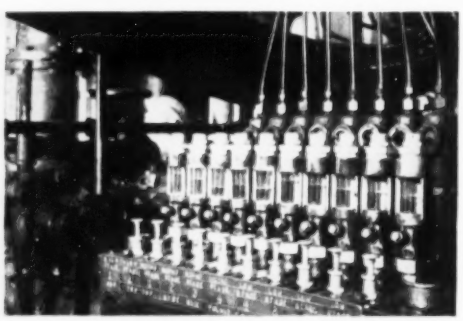
"The Sign of a GOOD Hose Clamp"

PUNCH-LOK Company

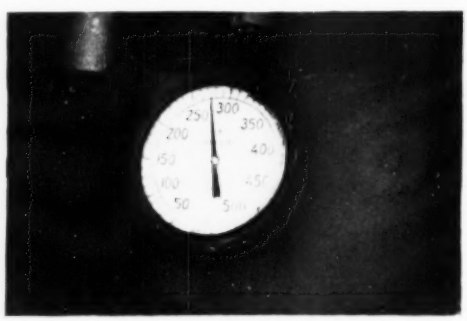
Dept. H, 321 N. Justine Street, Chicago 7, Illinois



". . . Cellulubes were tested for two years in four Air Compressors. Cylinder wear was negligible. Deposits normally found in compressor auxiliaries and valves were reduced or eliminated."



". . . A conventional lubricator will pump Cellulubes satisfactorily. No obnoxious vapors—does not present a personnel problem in terms of handling a toxic material."



". . . No pressure surges nor evidence of fire in the air accumulator when Cellulubes are used. They are excellent lubricants, and also are effective as detergents."

**CELANESE CORPORATION OF AMERICA, CHEMICAL DIVISION**
**DEPT. 596-C 180 MADISON AVENUE, NEW YORK 16, N. Y.**

Please send me:

☐ Technical bulletin ☐ Sample of_____viscosity.

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Application I have in mind_____

*From a trial file covering two years testing in 3-stage air compressors*

# "NO PRESSURE SURGES...NO EVIDENCE OF FIRE... EXCELLENT LUBRICATION...WHEN FIRE-RESISTANT CELANESE CELLULUBES ARE USED!"

"Cellulube has now been in four of our air compressors for approximately two years. The compressors were inspected during a recent Catalytic Reformer General Inspection. Cylinder liner wear was negligible, particularly when compared to the amount of wear we had experienced when previously using a synthetic lubricant. Cellulube, in addition to acting as a lubricant, is also effective as a detergent. Compressor cylinder air passages which had been heavily coated with carbonaceous materials and deposits laid down by the previous synthetic lubricant, are gradually being removed and the compressors again show the original factory finish. Deposits on valve cages and plates have been reduced and are no longer a problem.

"Cellulube does not present a personnel problem in terms of handling a toxic material. There are no obnoxious vapors from Cellulube. A conventional lubricator will pump Cellulube satisfactorily.

"There have been no pressure surges nor evidence of fire in the air accumulator.

"We believe this material is an excellent lubricant plus the fact that acting as a detergent the deposits normally found in compressor auxiliaries and valves have been reduced or eliminated."

These results are typical of what you can expect from Celanese Cellulubes. They have been developed to meet the pressing need for fire-resistant lubricants which virtually eliminate the problem of carbon deposits.

Cellanese Cellulubes are available in 6 controlled viscosities: 90, 150, 220, 300, 550, 1000, S.U.S. @ 100°F. These straight phosphate esters provide excellent lubricity, are non-corrosive and non-reactive.

Celanese Cellulubes open new areas for in-plant protection against fire and explosion. Evaluate them in your own operation. Use coupon to request samples and techincal data. Celanese® Cellulube®

Celanese CHEMICALS

Celanese Corporation of America, Chemical Division, 180 Madison Avenue, New York 16, N.Y.

*In Canada:* Canadian Chemical Co., Limited, 2035 Guy Street, Montreal, P. Q., Canada.

*Export Sales:* Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16, N. Y.

CELANESE CELLULUBES

all types of industries use

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all over the world

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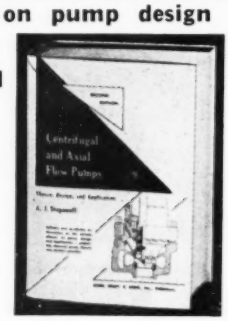

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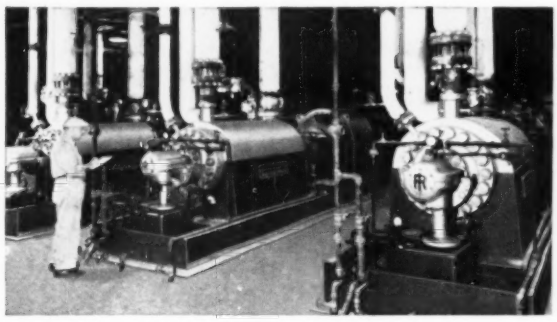

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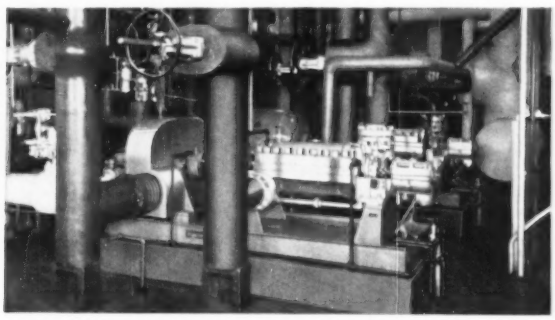
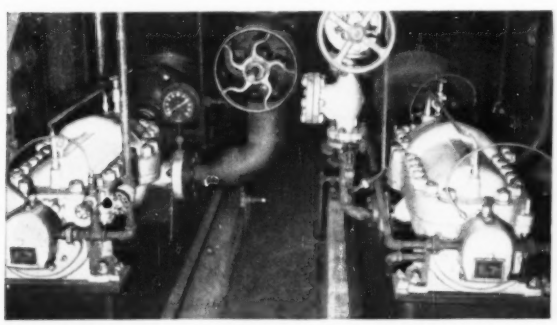
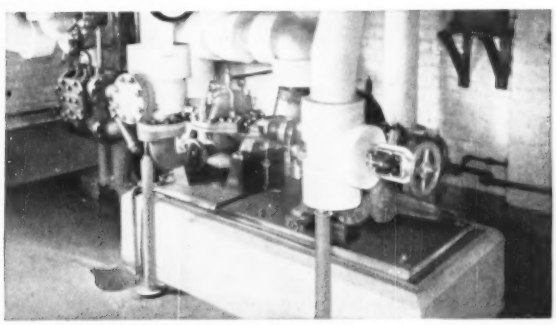


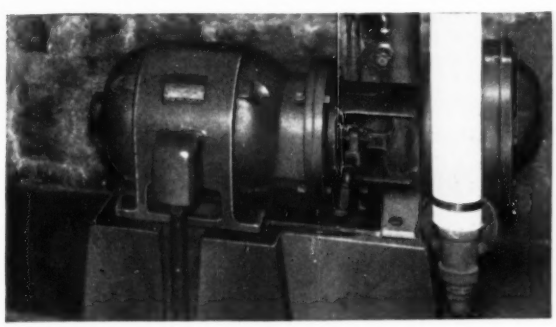
PRESSURES UP TO 1200 psi.—Class HMTA-HMTB: A complete line of multi-stage centrifugal pumps featuring a symmetrical, horizontally-split casing, and a simplified unit-type rotor assembly. The pumps illustrated are on boiler feed service in a large textile mill.



MEDIUM PRESSURES UP TO 1000 psi.—Class CNTA: Symmetrical design with unit-type rotor gives CNTA pumps higher efficiency, easier maintenance, and attractive modern appearance. Installed in a large paper mill, the boiler feed pumps shown operate at 3560 rpm and deliver 180 gpm at 605 psi.



PRESSURES TO 450 psi.—Class GT: Dependability is designed into this line of two-stage, horizontally split pumps. Standard construction includes renewable wearing rings and water-cooled, ring-oiled bearings. Pump shown serves as a boiler feed unit in a large candy factory.



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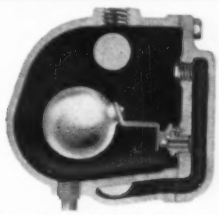
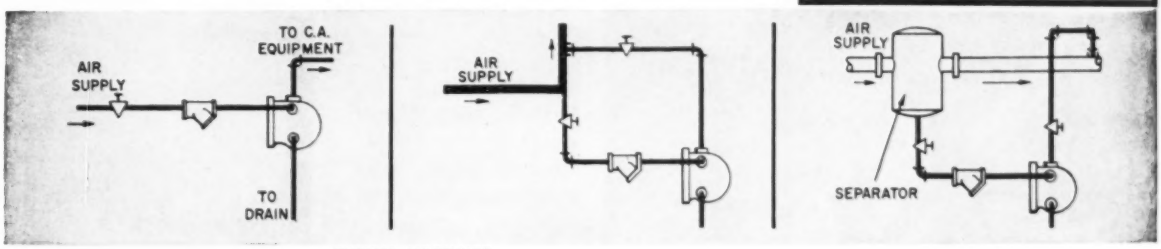
*and get more work from your CA tools*



Cross-section of Type FA Drain Trap showing float design that keeps condensate level above trap, providing seal against air leakage.

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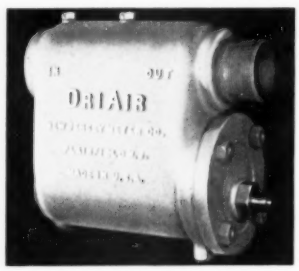


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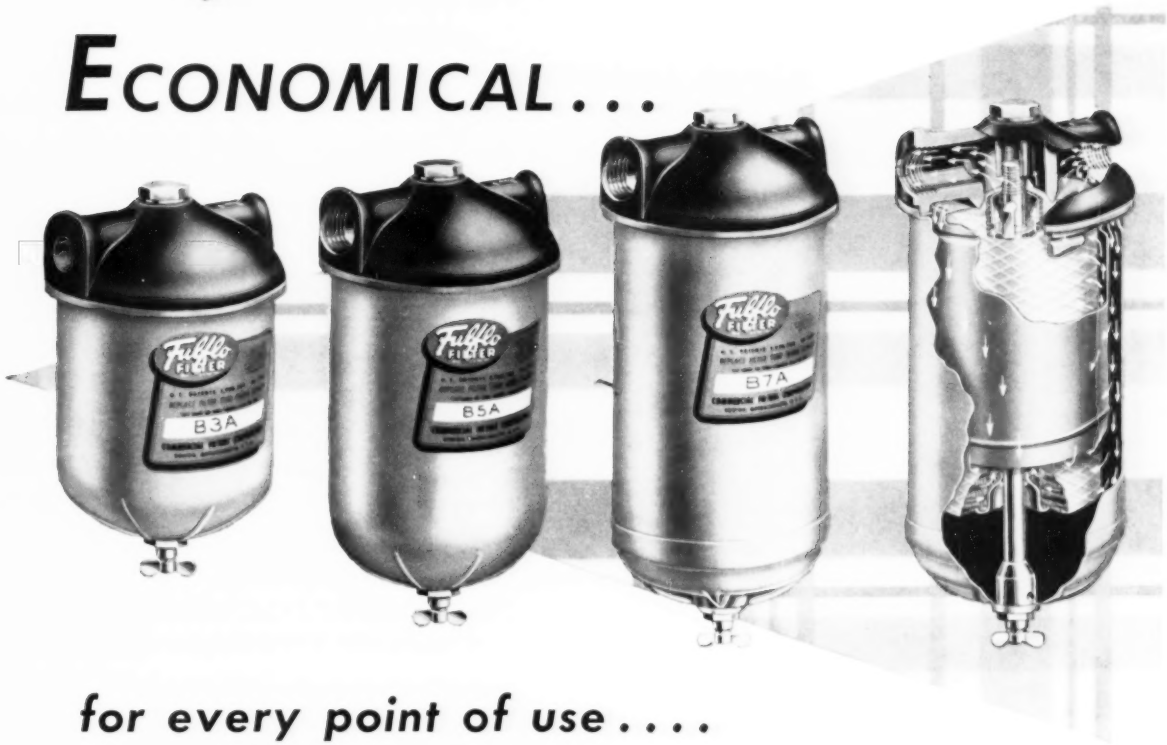


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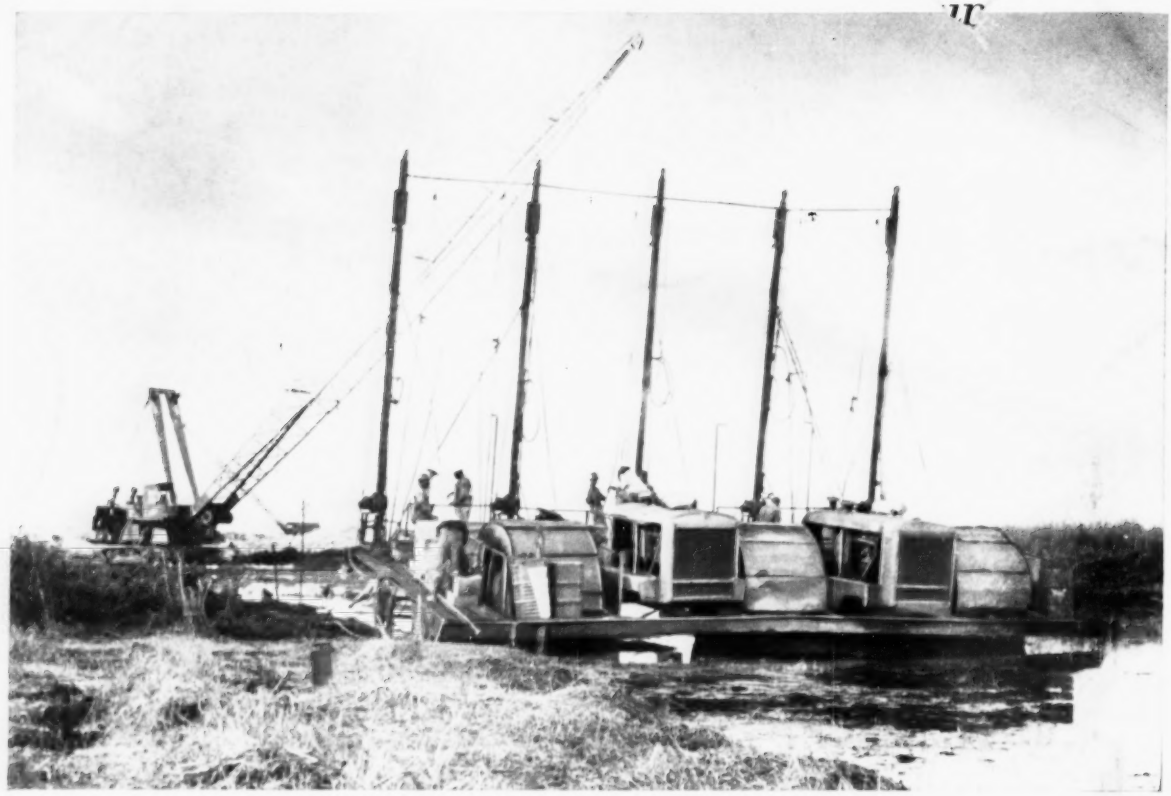

# LAND-WALKING SWAMP BUGGY

## SOLVES TOUGH DRILL JOB

In a remote area of the Florida Everglades, this unusual drilling rig is helping to blast out 11 miles of canals—part of the Florida Flood Control Project. Built and operated by the Clemens Construction Company of West Palm Beach, it has proved an ideal solution to the transportation and drilling problems involved. Riding on 7 large welded steel drums, it easily negotiates the muddy or swampy ground, often covered with several feet of water during the rainy season. Motive power is provided by two Quarrymaster air traction motors, with chain drive to the two end drums at the rear.

Each of the 5 steel towers carries an Ingersoll-Rand X-71WD heavyduty drill, modified for extra hole cleaning power, and an I-R D-6-U air hoist to handle the slabback and drill. Air power for drilling, propulsion and hoisting work is provided by two I-R 600 cfm Gyro-Flo compressors, mounted between driving drums at the rear of the platform.

Using $3\frac{1}{4}$" bits and 24' steels, this rig drills 16 to 20 ft. holes in a 9 by 9 ft. square pattern, 9 holes wide. The medium hard limestone ground, interbedded with loose shell, marl and sandstone, presented frequent difficulties from filling-in, requiring extra power for hole cleaning and removal of embedded steels. Yet despite these problems, production has averaged 200 holes per day, or about 3600 ft. per 10 hour shift!

For all the facts on drills and compressors to meet *your* requirements to best advantage, just get in touch with your Ingersoll-Rand representative.

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